AN OBSERVATIONAL STUDY TO DETERMINE THE ASSOCIATION OF CRANIOMAXILLOFACIAL INJURIES IN PATIENTS WITH CERVICAL SPINE INJURIES AT TERTIARY CARE CENTRE IN INDIA

Thesis submitted to the faculty of

All India Institute of Medical Sciences, Bhopal

FOR DEGREE OF MCH NEUROSURGERY

(JULY 2022 – JUNE 2025)

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1. Covering letter, Undertaking and Certificates

COVERING LETTER

To,

The Chairperson,

IHEC-PGR, AIIMS Bhopal

Subject: Submission of Thesis

Respected sir,

I, Dr. Kaustav Saha, have joined the Department of Neurosurgery at AIIMS Bhopal as a MCh Senior Resident in July 2022 session. I am hereby submitting my Thesis titled "**An observational study to determine the association of Craniomaxillofacial injuries in patients with cervical spine injuries at Tertiary care Centre in India**" for your kind approval.

Thanking you.

Yours sincerely,

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i

UNDERTAKING

I, **Dr. Kaustav Saha**, MCh Senior Resident registered in batch July 2022, hereby declare that the data submitted for my MCh degree belongs to me and is original. I also certify that the work was done by me to carry out this study.

This institute shall not be responsible for any dispute or any conflict of interest that may arise out of this thesis at any stage.

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This is to certify that the thesis entitled "**An observational study to determine the association of Craniomaxillofacial injuries in patients with cervical spine injuries at Tertiary care Centre in India**" is a bonafide and genuine research carried out by **Dr. Kaustav Saha** under guidance and direct supervision for award of MCh Neurosurgery degree.

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DECLARATION

I hereby declare that the thesis entitled "**An observational study to determine the association of Craniomaxillofacial injuries in patients with cervical spine injuries at Tertiary care Centre in India**" is a bonafide and original work carried out by me under the guidance of **Dr. Pradeep Chouksey,** Associate Professor, Department of Neurosurgery. The thesis or any part thereof has not formed the basis for the award of any degree/fellowship or similar title to any candidate of any university to the best of my knowledge.

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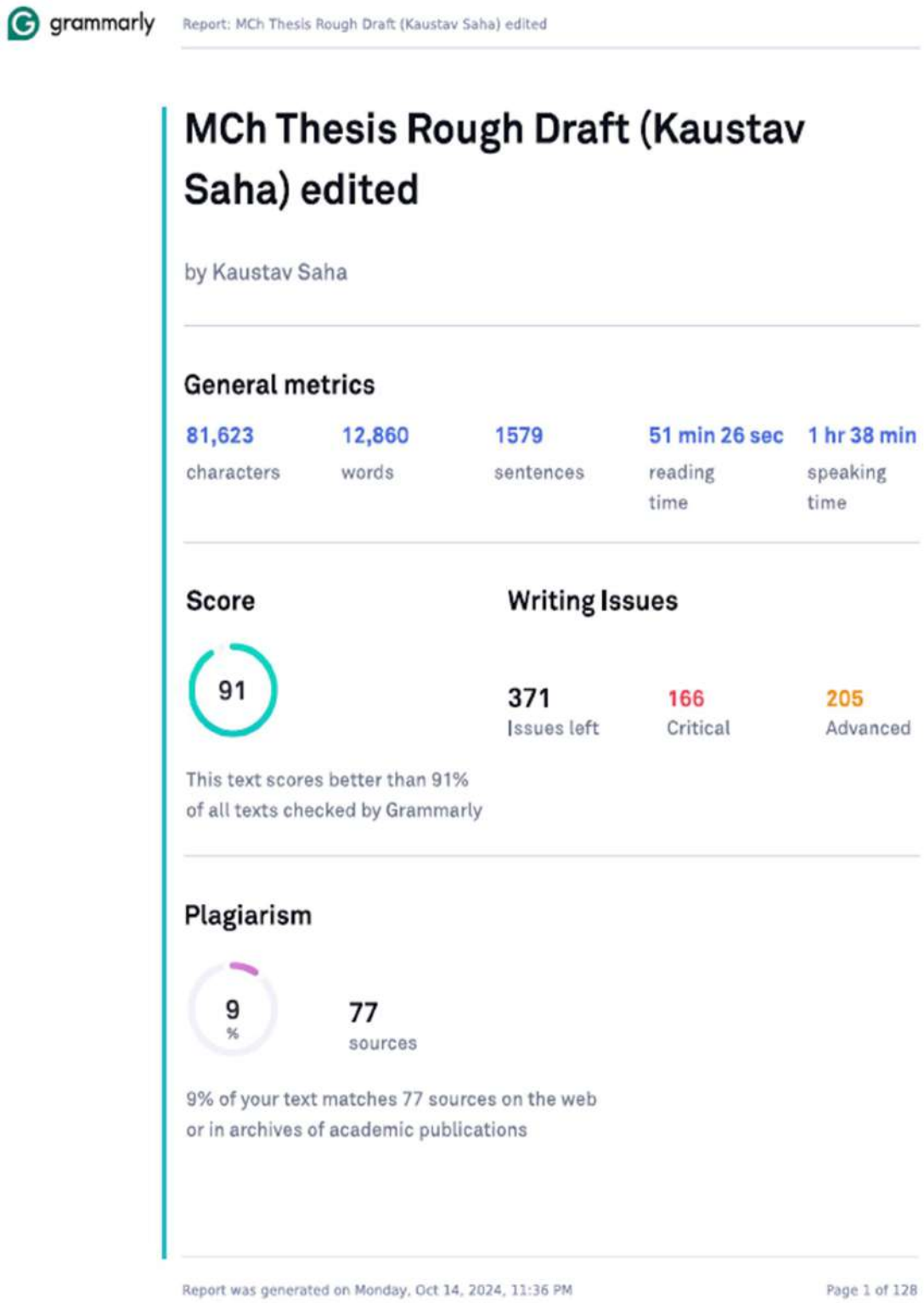

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3. Letter of Permission from IHEC

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Institutional Human Ethics Committee- Student Research (IHEC-SR)

www.aiimsbhopal.edu.in Email: ihecpgr@aiimsbhopal.edu.in

Ref Number:AIIMS/BPL/IHECSR/July/22/SS/05 **Date:** 28th February 2023

Letter of Permission

Student Investigator: **Dr. Kaustav Saha** **Neurosurgery**	**Guide:** **Dr. Pradeep Chouksey** **Neurosurgery** **Co-Guides:** **Dr Amit Agrawal, Dr Adesh Shrivastava, Dr Jitendra Sharma, Dr Babu Lal Soni**

AIIMS, Bhopal Institutional Human Ethics Committee- Student Research (IHEC-SR) in its 7th meeting held on 22nd February 2023 discussed your proposal titled **"An observational study to determine the association of craniomaxillofacial injuries in patients with cervical spine injuries at tertiary care center in India."** and evaluated it for suitability for your dissertation as required for fulfilment of DM/M.Ch program.

Following members attended the meeting:

1. Prof. D. K. Pal, Former HoD Community Medicine, GMC, Bhopal.....Chairperson
2. Prof. Rajnish Joshi, Professor of General Medicine, AIIMS, Bhopal.....Member
3. Prof. Amit Agrawal, Professor of Neurosurgery, AIIMS, Bhopal.....Member
4. Dr. Sunita Athawale, Professor of Anatomy, AIIMS, Bhopal.....Member
5. Dr. Girish Bhatt, Addl. Professor of Paediatrics, AIIMS, Bhopal.....Member
6. Dr. Ujjawal Khurana, Assoc. Professor of Pathology, AIIMS, Bhopal.....Member
7. Dr. Ankur Joshi, Assoc. Professor of CFM, AIIMS, Bhopal.....Member
8. Mr. Trivesh Goswami, Law Officer, AIIMS Bhopal,.....Member
9. Dr. Shashank Purwar, Professor of Microbiology, AIIMS, Bhopal.....Member Secretary

The decision of the committee is as follows:

The AIIMS, Bhopal IHEC-SR approves your research protocol. All research related activities must begin only after the date of this approval. The validity of this approval is till two years from the date of issuance. Please submit a closure report / renewal request before expiration of the validity for this approval.

Shashank Purwar

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4. Acknowledgement

First and foremost, I kneel down before Almighty God for his unconditional unwavering grace and blessings entrusted in me. I am deeply grateful for the presence and encouragement of my grandparents and parents, together with the love and laughter of my siblings, which has been pillars of my strength throughout this journey.

I take this opportunity to thank our Honourable Director, the Dean of Academics, the members of the Institutional Human Ethics Committee (IHEC) and the Thesis Review Committee for granting me the opportunity to pursue this thesis and conduct research work.

My deepest gratitude goes to my guide, **Dr. Pradeep Chouksey,** Associate Professor, Department of Neurosurgery. It has been an honour to conduct and successfully complete this study under his guidance and consistent motivation with his continuous drive for a quality research work. I also extend my gratitude to my co-guides **Dr. Amit Agrawal, (**Professor and HOD, Department of Neurosurgery), **Dr Adesh Shrivastava (**Additional Professor, Department of Neurosurgery), **Dr Babulal (**Assistant professor, Trauma and Emergency department), and **Dr. Jitendra Sharma (**Assistant Professor, Department of Radiodiagnosis**)** for their invaluable support throughout the study.

I am profoundly grateful to **Dr. Amit Agrawal, (**Professor and HOD, Department of Neurosurgery), for his kindness, approachability and willingness to address any issues, thereby facilitating the smooth progress of this study.

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Lastly, I would like to express my heartfelt thankfulness to the patients and their families and support from all teachers, colleagues, nursing staff and technicians for making study possible.

Dr. Kaustav Saha, Senior Resident, Neurosurgery

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5. Introduction

Trauma is a big issue for public health. Each year, around 4.4 million people lose their lives because of it. According to WHO's 2024 facts about trauma & violence, out of these deaths, unintentional injuries cause about 3.16 million, while violence-related injuries take away 1.25 million lives. When we look closer at these numbers, we see that roughly 1 in 3 deaths comes from road accidents, 1 in 6 from suicide, and 1 in 10 from homicide. War & conflict account for about 1 in every 61 deaths. Trauma will gradually become one of the top 20 causes of death worldwide by 2030. For young people aged between 5 and 29, three out of the five top causes of death are related to injuries like traffic accidents, suicides & homicides[1].

Head and neck trauma include fractures of facial bones or soft tissue injuries in the face & cervical fractures or cord contusions or herniated intervertebral discs. Most of the injured patients end up with some type of head or neck trauma—sometimes alone or in association with other injuries[2]. This refers to any major injury that could lead to grievous hurt or even death— a single big injury or multiple injuries to different body parts. Severity of the trauma is assessed by the Injury Severity Score (ISS)[3]. If a person scores ≥ 16 on this scale, it accounts as a red flag sign for major trauma. The score is calculated by a sum up of the scores of the three worst injuries of a patient.

Head and neck injuries are often managed by multi-speciality approach—like maxillofacial surgeons, plastic surgeons[4] & neurosurgeons[5] working together.

Studies over the past have shown that patients with maxillofacial fractures are at high risk for cervical spine or spinal cord injury[6]. This fact is of utmost importance while managing these patients – right from shifting the patient from the place of incidence to the hospital, during intubation, clinical and radiological examination and timing of management. This all plays a significant impact on the clinical outcome of these patients.

Most cervical spine injuries linked with facial fractures come from forces passed from the face to the cervical spine and soft tissues[7]. Patients suffering high-speed RTAs are often at greater risk for these kinds of cervical spine injuries than someone falling from height[8].

Patients with head & neck injuries (especially in the cervical area), more likely suffer from spinal cord injury [9]. It is essential that all patients with facial trauma should also be examined for cervical spine injuries to maintain airways and treat facial fractures effectively[10]. Since

force is transmitted directly or indirectly from the facial skeleton to the cervical vertebra and soft tissue and causes spinal cord injuries, maxillofacial trauma is assumed to play a significant role in management and outcome of cervical spine injuries[11] . The cervical spine fractures are seen to be more common in high velocity injuries, and less common in low-risk injuries like fall from heights and workplace violence[12].

There are no sufficient local data showing how maxillofacial fractures are related to cervical spine injuries. Between 2% and 10% of patients with facial fractures also have concomitant cervical spine issues[13]. Road traffic accidents & fall from heights are most common causes for concomitant maxillofacial and cervical injuries[14]. Missing these cervical spine injuries in the Emergency results in poor outcome and higher risk for long-term damage or even worse outcomes like serious neurological issues or death. Thorough clinical examinations with radiological imaging are important when diagnosing cervical spine problems in patients with maxillofacial injuries.

Cervical spine injury also has significant impact on determining airway management, diagnostic evaluation, surgical procedure, and timing of repair of maxillofacial trauma (Elahi et al., 2008). Hence Trauma protocols should definitely highlight how crucial it is to understand the pathophysiology of concomitant maxillofacial and cervical spine fractures because missing any one could lead to serious consequences (Elahi et al., 2008). Also trauma protocols including the Advanced Trauma Life Support ® manual stresses on the importance of the association between CSI and maxillofacial injury, and the untoward consequences that can follow if the diagnosis of either one is missed or its presence or absence being ignored.

Various studies have reported different incidences of cervical spine injury based on factors like the aetiology and demographics. But it needs more clarity on how exactly these injuries relate and which types are most concerning when associated with maxillofacial fractures.

Most cervical spine injuries in association with facial trauma result from force passing through the face down into the neck area. Studies (Davidson and Birdsell[15], 1989, Ardekian et al.[16], 1997) have shown that people in high-speed car accidents are likely to have severe neck injuries than those falling from height or getting hurt at work (Lewis et al., 1985, Haug et al., 1991, Merritt and Williams, 1997, Chen, 2008, Elahi et al., 2008, Hoppe et al., 2014, Halsey et al., 2016).

This study aimed to gather all cases during one year at AIIMS in Bhopal on finding the association in incidences of concomitant maxillofacial injuries in cervical spine injury patients. This will definitely help surgeons all over the world in making accurate diagnosis quickly resulting to better management and further clinical outcomes ahead. The objectives of the study are to investigate the incidence, and elucidate the exact nature of and the relationship between Cervical spine injury and maxillofacial fractures, focusing on the initial presentation and need for imaging and management of combined injuries, in order to assist the maxillofacial surgeon in the reliable and prompt diagnosis of Cervical spine injury, and in identifying its implications for the repair of maxillofacial fractures.

6. Rationale for the study

Head and neck injuries incidences are very high in high-income countries (HICs). But the scenario is different for low and middle-income countries (LMICs). India ranks at 20% of the world's total trauma mortalities, yet the real effects and outcome of head & neck trauma seem to be underreported.

Most studies about head & neck injuries in India are pretty narrow, focussing on one type of injury or one hospital. Often, specific head and neck injuries are associated with other injuries like long bone injuries or brain trauma or thoracoabdominal trauma. This makes it difficult to find a clinicopathological association between cervical and maxillofacial trauma.

Learning more about head and neck trauma in India will provide knowledge to help with research, manage resources better, and improve education for better patient care. Research shows that cervical spine injuries are often associated with craniomaxillofacial injuries in high velocity RTAs. This creates challenges for managing airways and treating concomitant facial injuries properly. There is also no clear protocol on timing of managing these combined injuries.

Our goal is to take a closer look at cervical spine injuries and their connection to craniomaxillofacial injuries based on data from a trauma centre in central India. There is not sufficient information on this area of interest, looking at the association among patients with cervical spine injuries in India so far. Our study aimed to find a clinicopathological and demographic association of the above in Central India.

7. Review of Literature

Facial trauma includes head, face, and jaw bone injuries. Facial trauma has high prevalence worldwide and is one of the most common causes of admission into the Trauma Emergency since the most unprotected part of the body is the face. By the age of 40, trauma is the most common cause of death, and facial injuries are one of the most common traumatic injuries reported to emergency departments. Culture and the socio-economic status of a country much decides the aetiology of facial trauma.

It has been found in studies by Farkkila et al.[17]in 2019 and Mukherjee et al.[18] in 2015 that MVA is the leading cause of the combined MFT and CSIs because the strong force of impact in case of high speed injuries (RTA) distributes from the facial region to the cervical spine (Ardekian et al.[16], 1997). Another fact is the possibility of the head being over flexed or overextended during the impact resulting in a CSI (American College of Surgeons 2008).

The mandible was reported to be the most common location of the combined head and neck injuries; this is because mandible, being an isolated bone is the least protected in the facial skeleton (Oji, 1999)[19]. It is also the largest and the most prominent bone of the face (Nwoku, 2004)[20]. Also the U shaped structure of the mandible is responsible for increased risk of mandibular fractures (Infante Cossio et al., 1994)[21]. Hence it was reported to be the most common location of the concomitant CMF and CSI in several studies of the past (Chen, 2008; Soleimani et al., 2015)[22]. However, Sajjad et al (Rahman and Chandrasala, 2014)[23] reported that the midface was the most common location of fractures that result in CSI following an MFT. The mandible and the midface were the most common facial injury locations that combined cervical spine involvement; this was explained by the possible association of the upper cervical spine with the mandible and the lower cervical spine with the midface (Lalani and Bonanthaya, 1997)[24].

Haug et al.[25] in their survey observed that of 402 patients, 67% suffered mandibular fractures, 21% zygomatic fractures, and 11% maxillary fractures. Obuekwe et al.[26] in his study reported the mandible to be the most common site of facial fracture, followed by the middle face including the ZMC. This was thought to be due to the prominent size and position of the mandible which made it more susceptible to high velocity injuries. In the mandible, para-symphysis fracture was found to be more common.

Hampson et al.[27] explained that the mid-facial bone tolerance to the impact of force is much lower than the frontal and mandibular bones thereby allowing the force to transmit to the base

of the skull and cranium. Udeabor et al. attributed this due to the proximity of the mid-face to the cranium. It has. been observed that the multiple mid-facial fractures were associated with 1.6 a fold risk of traumatic head injuries.

Males outnumbered females in studies that reported male predominance of injury with 2.7:1 (Obuekwe and Etetafia, 2004), 6:1 (Hussain et al., 2003)[28], and 1.74:1 (Li et al., 2015)[29].

The association of CSIs with MFFs was recorded in studies, in which a percentage of CSI involvement ranging from 1% (Baker and Mackenzie, 1976)[3] to 6%(Tu et al., 2010)[31] has been recorded.

The most common location of CSIs in studies reporting that the C2 spine was the most commonly involved vertebrae (McMordie et al., 2020[32]; Menger et al., 2020). This may be explained by the fact that cervical spine fractures are mainly due to improper movements such as hyperflexion, hyperextension, and rotational movements (Modi et al., 2016)[33] of the C2 spine, which accounted for 50% of the rotational movements because of its loose articular capsules (Bhimani et al., 2018)[34]. It was also explained by the the possible relation of C2 injury with patients' age as reported by Ryan and Henderson (Ryan and Henderson, 1992)[35], that incidence of C2 injuries increases with age, as demonstrated in this study where only adults had C2 injuries. This is because adults reported to have a low cranio-facial ratio of 2.5:1, whereas in case of children, it is 8:1. Additionally, children also have underdeveloped paranasal sinuses and unerupted teeth, which makes their facial skeleton solid and hence more volatile (Zimmermann et al., 2005)[36].

Akama et al.[37] reported an incidence of 9.2% and stated that cervical fracture is critical as it can lead to serious consequences if neglected during the primary survey. Most of the cervical spine injuries were found to be due to RTA and found to be in association with mandibular fracture in all reported cases. The spine injury level involved was C1 and C2 in two cases and C7 in four cases. This finding correlated with that of Ardekian et al. Cervical spine trauma can be missed in the primary survey, especially when injuries of other regions dominate, hence one has always to be cautious with a thorough physical examination during the survey. Cervical spine immobilization should be the first step unless otherwise cervical spine injury has been excluded both clinically and radiologically and extreme caution to be taken in manoeuvring the unconscious, sedated, or non-alert patients who are suspected of cervical spine injury.

Approximately 4–30% of CSIs have been neglected and unreported (Bohlamman, 1979[38]; Gerrelts et al., 1991)[39]. Possibility of CSI should always be excluded in maxillofacial trauma

patients with CT scan in the Emergency. Nevertheless, CTs miss out CSI in 0.04% percentage patients (Sanchez et al., 2005)[40]. Lateral view X rays should be avoided as false-negative results can reach up to 40% (Andrew et al., 1992)[41] and gives insufficient information about significant anatomic structures such as the odontoid (Ardekian et al., 1997; Beirne et al., 1995). Therefore, CT should always be the primary diagnostic imaging when a CSI is suspected in combination with MFT during primary survey. However, signs and symptoms of high-risk patients should be identified early to make a primary diagnosis of a possibly associated CSI, which include paraesthesia, neck pain with or without radiculopathy with neck stiffness, decreased and painful range of neck movements, and focal neurological deficits, if any. (Roccia et al., 2007)[42].

Furthermore, multiple studies reported that patients with a combined maxillofacial trauma and cervical spine injury generally have a low GCS score (Demetriades et al.,2000[43]; Elahi et al.,2008; Holly et al.,2002[44]; Sinclair et al.,1988) and those with GCS of less than 8 supposedly have a concomitant CSI (Choonthar et al.,2016).

Plaisier et al.[45] observed lower GCS and higher ISS values in non-surviving patients who exhibited a dramatic predilection for mid-and upper facial fracture patterns.

Road accidents are a major cause of morbidity and mortality. The face, being the most visible part of our body, often gets hurt in these incidents. Patients with facial injuries usually have other injuries too, especially to their heads and necks. It's a common thought that if someone has facial trauma, doctors should check for neck injuries until they prove there aren't any. Recently, a study by **Jamal et al.**[46] and others backed this idea. According to the World Health Organization (WHO), India has some of the highest rates of road accidents worldwide. So, it's really important to look into how neck injuries & facial injuries might be connected. When there is neck injuries involved, treatments can change. This may also delay fixing facial fractures. However, we can reduce delays by getting a neurosurgeon involved early on. They help stabilize neck injuries. Also, when doctors put patients under anaesthesia for surgery, they need to be very careful. Using endoscopic guidance for intubation can help avoid moving the head too much.

This study aims to look closely at how maxillofacial injuries relate to cervical spine injuries. We want to understand why these combined injuries happen, profile the patients better, and examine patterns of facial fractures. Furthermore, we'll consider levels of cervical spine injury and what management options work best. We will also look at outcomes with ASIA

scores, ICU complications, and overall mortality rates. All this information can smooth out treatment paths and improve recovery for patients.

Jamal BT et al.[46] in 2009 reported that falls were the leading cause of cervical spine injuries with maxillofacial fractures. Contrary to the old belief, **Mubeen et al**[47] in 2023 reported that the chances of cervical injuries related with facial fractures rises when caused by **high-speed incidents**, such as car accidents. This was explained by the fact that the maxillofacial area receives more force from the impact of trauma than it got transmitted to the neck.

Subhasraj *et al.*[48] in 2007 also studied 2748 maxillofacial injury patients in Chennai and he reported an incidence of 62% of injuries from two wheelers and 23 % from four wheelers in Indian roads, respectively.

Keita *et al.*[49] in 2010 with 184 patients in Mali, found 93% road traffic accidents causing maxillofacial injuries. This can be attributed to local conditions like bad roads and lack of restraints, hence road traffic accidents proved to be the most common cause for maxillofacial injuries and cervical spine injuries.

Hackl et al[50] during a period of 4 years (1995 to 1998) with 3083 patients, reported that traffic accidents accounted for 43.7% of combined facial and cervical spine injuries.

Mukherjee et al in his 6-year retrospective analysis in UK, reported that 88% of CSI cases were associated with trauma with a fourfold higher incidence of concomitant injuries due to RTA than due to fall from height.

Our study found a 66% association of RTA with combined Cervical and Craniomaxillofacial injuries whereas 30% resulted due to fall from height – indicating double the percentage. The increase in association of CSI with RTAs (as opposed to falls and other traumatic incidents) is explained by the greater velocity and resultant force of impact to the face and force is the product of mass and acceleration. This traumatic force is transmitted through the facial skeleton into the cervical spine, causing spinal cord injury. Times when patient is not wearing a seatbelt and he is subjected to indirect cervical spine injury as his head easily gets hyperflexed or hyperextended by the force of impact with either windshield, steering wheel or other structures inside the vehicle.

Mubeen et al[47], in a study of 120 maxillofacial injury patients in 2023 reported the mean age of 27.21 ± 9.9 with a 64.7 percent of patients are in the 40 to 45 age range.

Isfahan et al[23] in a prospective cohort of 124 patients in 2014 reported most of the patients with combined cervical and facial injuries fell in the range of 21-40.

Alexander et al[51] in a retrospective study with 12329 patients reporting at a trauma centre at Kasturba Hospital in Manipal during a 5-year period (January 1, 1995 to December 31, 1999) with facial fractures and cervical injuries found the ages of the patients ranging from 7 to 70 years with mean age being 32 years.

Ugboko et al[52] in a retrospective review of 442 patients, saw that approximately 72% of the patients sustained fractures from road traffic accidents and 39% of the fractures occurred in the 21-30-year range with a a male preponderance.

Haug et al[25] in 1990, in a 5-year review of facial fractures and concomitant cervical injuries at a level 1 trauma centre, reported that the majority of facial fractures were found in males; the most prevalent age range being 16 to 30 years.

Hogg et al[53] in a retrospective study of 2969 patients from Ontario Trauma Registry found the median age to be 25 years, and men injured at a 3:1 ratio over women.

Hackl et al[50] during a period of 4 years (1995 to 1998) with 3083 patients, reported that Facial trauma patients with concomitant cervical spine injuries were significantly older (mean age, 42 years) with a female/male ratio of 30:70.

Our study found 36% patients in the range of 21-30 years, similar to other studies conducted in the recent past with minimum % <20 and >70 years. The mean age of the patients was found to be 37.1000 ± 15.0201.

Males outnumbered females in our review with 76% males and 24 % females – a ratio of 3:1. This finding coincides with other studies that reported a male female ratio of 2.7:1 (**Obuekwe and Etetafia, 2004**)[26], 6:1 (**Hussain et al., 2003**)[54], and 1.74:1 (**Li et al., 2015**)[55].

Higher incidence of males is explained by higher involvement in outdoor activities, lack of awareness of necessary preventions, higher involvement in sport activities, and higher availability of weapons (**Boffano et al., 2014**)[30].

Numerous researches have been done recently, but the prevalence of combined CSI and CMF injuries in each study differs. The majority of these studies concentrated on certain fracture types, such as those of the mandible or maxilla, or on a grouping of all craniomaxillofacial fractures.

Mubeen et al[47] found a 3.3% incidence of combined cervical and maxillofacial fractures, quite similar findings from earlier studies (0% to 4.3%).

Bicsak et al[56] found 2.47% of all MFI patients were diagnosed with a concomitant CSI. This is comparable with the literature but is lower than the international average (0.8% to 12%). This incidence percentage is quite less than what was reported by **Pietzka et al**. in the German registry study (11.3%) or single instituition studies from the USA and UK, but Roccia et al from Italy reported more than 0.8% incidence.

Mukherjee et al, in his 6-year retrospective analysis on 714 patients with maxillofacial fractures reported that 56% of patients with Cervical spine injuries had a combined maxillofacial fracture pattern. These findings likely reflect that patient with cervical spine injuries has a much higher association with maxillofacial fractures than the other way round. This is due to the fact that greater force of injury plays a significant role when two or more facial regions have been fractured in comparison to isolated facial region, which in turn gets transmitted to the cervical spine.

Our study focused on association of maxillofacial injuries in a population of cervical spine injuries and found that 58% of patients suffered concomitant craniomaxillofacial injuries with Cervical spine injuries.

In relation to the location of the facial fracture, in their discussion of the standard cervical injury model, **Lalani et al** and **Bonanthaya at al**[24] discovered that injuries to the lower third of the face (mainly Mandible)are mostly associated with upper cervical spine injuries while midface fractures are more common with lower cervical spine trauma**.**

Bicsak et al[56] found that injuries located near to the cranial base (Mid face) both in central and in lateral areas of the facial skull are significantly associated with CSI than other regions of the face (87.7% cases). This level correlates approximately with the Frankfurt horizontal plane. Fractures in the Frankfurt plane cause grievous injuries of the Cervical spine, thus Bicsak et al. called this region of the face as "**Cervical Spine Injury Alert Bend**". After a detailed analysis of these papers, a higher incidence of CSI is reported in more cranial fractures of the lower jaw, like fractures of the mandible. Their analysis of concomitant midfacial fractures and CSI provided a very similar result than our study.

Our study showed mid facial fractures more commonly associated with both Upper cervical and lower cervical injuries, more common in upper cervical (25%) than lower cervical

(11.5%) and isolated mandible fractures more common with upper cervical injuries (4.2%) at the level of C2 and no patient had isolated mandible fracture with concomitant CSI.

The association of CSI incidence in combination with isolated mandibular fractures is much lower than the old belief. The mandible moves on its articular surface in relation to the glenoid fossa, hence force impact on the mandible is not transmitted directly to the cervical spine, unlike in case of middle and upper face fractures. This explanation supports the belief that the mandible dissipates the energy from impact and protects the head and neck from the trauma force of impact. Interestingly, and even conversely, **Chu et al**. reported that patients sustaining multiple mandibular fractures had fewer CSIs than patients with isolated mandibular fractures. The authors reported that the facial skeleton absorbs most of the transmitted energy and spreads it throughout the facial bones, transmitting a much lesser force to the cervical spine (**Chu et al., 2016**)[17]. Clayton et al. on the other hand, suggested that the cervical spine may be more commonly associated with inertial differences between the head and torso, as opposed to transmitted compression forces from head or facial trauma (**Clayton et al., 2012**). Both these explanations are relatable, but case wise differences will persist based on the corresponding trauma mechanism. Recently, **Farkkila et al.**[17] reported that isolated fractures of the mandibular ramus condyle unit are risk factors for increased CSI risk (**Farkkila et al., 2019**[17]). However, combined CSI and facial fractures significantly increases the risk. The important study by Chu et al. proposed that mandibular fractures are commonly associated with CSIs (Chu et al., 2016). However, in their study, they did not specify whether the exclusion criteria covered patients with concomitant facial fractures other than mandibular fractures. On the basis of these discrepancies, we propose that even though lower facial/ mandibular fractures incidences are quite significant in combination with head and neck injuries, association of isolated lower facial fractures with CSIs are much less reported than previously was believed.

Numerous publications have suggested midfacial fractures to be strongly associated with CSI **(Mukherjee et al.**[18]**, 2015; Reich et al.**[57]**, 2016; Mourouzis et al.**[58]**, 2018; Xun et al.**[59]**, 2019).**

Sajjad et al(**Rahman and Chandrasala, 2014**)[23] reported that the midface was the most common location of fractures that result in CSI following an MFT. Cervical spine injuries are significantly associated with mid face and lower facial fractures - this is explained by the

possible relation of the upper cervical compartments with the mandible and the lower cervical compartments with the midface(**Lalani and Bonanthaya**[24]**, 1997**).

CSI occur principally at two levels, C1/C2 and C5/C6/C7, accounting for almost 70% of all CSI. This finding is supported by **Elahi et al**, who showed that 67% of 124 CSIs associated with maxillofacial trauma occurred at the C1/C2 and C6/C7 levels. It is possibly explained by the fact that the loose articular capsules of the C1/C2 joint, together with shallow articular facets of the C1, produce the quite significant inherent instability of the cervical spine at C1-C2 joint, allowing approximately half of all its flexion, extension and rotational movement. This finding correlates with other studies which reported the C2 spine to be the most commonly involved vertebrae of the cervical spine (**McMordie et al., 2020, Menger et al., 2020**). The relatively greater degree of rotational movement permitted in the cervicothoracic junction at C5/C6/C7 may account for the higher frequency of injuries found at this level.

Our study found 10.7% CSI at C1/C2 level 66% incidence of CSI at C5/C6/C7 level with maximum at C5 (31.9%). Also, frequency of cervical disc herniation and cord contusion was more common in lower cervical injury level than in the upper cervical injury level. This difference may be due to accentuation of direct and indirect forces transmitted from the facial skeleton further down the spinal cord[60]. Another explanation asserts that the significant ligamentous anatomy of the C1/C2 region, compared with lower levels of the sub-axial cervical spine, serves to protect the spinal cord from injury. A further biomechanical mechanism states that the smaller diameter of the cervical spinal canal at C6/C7 versus that at C1/C2 is associated with an increased risk of cord injury.[61]

8. Aims and Objectives

1. To estimate the incidences of combined cervical spine with Craniomaxillofacial injuries in patients of cervical spine injuries coming to AIIMS Bhopal

2. To determine the anatomical level of cervical spine injuries and each of their association with types of Craniomaxillofacial injuries.

3. To assess the outcome in patients with combined injuries.

9. Materials and methods

9.1 Study Design

Observational, prospective Cohort study

9.2 Study setting

Patients with Cervical spine injuries and associated Craniomaxillofacial injuries who came to Trauma emergency and Neurosurgery department of AIIMS Bhopal.

9.3 Study Period

Entire study was conducted for a period of 15 months with a follow up of 6 months, from the date of obtaining ethical clearance.

9.4 Sample size

We aimed to conduct this study with minimum of 50 patients coming to Trauma emergency of AIIMS Bhopal.

9.5 Sampling Technique

All patients who came to Trauma emergency of AIIMS Bhopal with cervical spine and combined injuries were recruited for the study.

9.6 Study unit

Patients who came to the Department of Trauma emergency with Craniomaxillofacial and cervical spine injuries represented the study unit.

9.7 Inclusion criteria

All patients more than 18 years and less than 70 years, who came to Trauma emergency with cervical spine injuries with or without Craniomaxillofacial injuries.

9.8 Exclusion criteria

- Pregnant patients
- Patients with severe medical comorbidities.
- Patients <18 years and >70 years.
- Patients not giving consent for the study.
- Patients with additional injuries like abdominal, thorax and long bone injuries.
- Patients with intraparenchymal head injuries.

9.9 Statistical analysis

Data for our study was put into a Microsoft Excel spreadsheet. After that, we analysed it using SPSS (version 27.0) and Graph Pad Prism (version 5). For the numbers, we used mean and standard deviations. For categories, counts & percentages were our go-to. When it came to finding the difference in means, we did two-sample t-tests. These tests were used on independent or unpaired samples. On the other hand, paired t-tests had more power than unpaired ones because they're a type of blocking.

A chi-squared test ($\chi 2$ test), a hypothesis test that uses a chi-squared distribution when the

null hypothesis is true was used. Chi square test also known as Pearson's chi-squared test. We compared unpaired proportions using either the Chi-square test or Fisher's exact test—whichever fit best. To carry out these t-tests, there are specific formulas used. Each formula gives a test statistic that either closely follows or exactly matches a t-distribution if the null hypothesis is right. Additionally, it provides the necessary degrees of freedom for each case. Once t value is obtained, we can find the p-value from Student's t-distribution table. If this p-value is lower than our set significance level—usually 0.10, 0.05, or 0.01—we reject the null hypothesis in favour of the alternative one. A p-value of ≤ 0.05 is deemed statistically significant.

9.10 Outcome

9.11 Data collection

All patients diagnosed with cervical spine injuries, combined with Craniomaxillofacial injuries will be included and assessed using the questionnaires and scales mentioned. Routine investigations will be collected for all patients. Aetiology of trauma, characteristics of the injuries and their association with each other, timing of management and their outcomes will be evaluated thoroughly in due course of study time.

9.11.1 Primary Outcome

1. Levels of cervical spine injuries and each of their association with zones of Craniomaxillofacial injuries.
2. Incidence of combined maxillofacial and cervical spine injury patients in patients with Cervical spine injuries
3. Six month clinical and radiological outcome of combined maxillofacial and c spine injury patients

9.11.2 Secondary Outcome

1. Mean age range and gender predominance in combined CMF and CSI
2. Most common aetiology and mechanism of injury in combined CSI and CMF
3. Evaluating neurological deficit and ASIA score in combined injuries

9.12 Strength of this study

India contributes about 20% of all global trauma mortalities, and the impact of craniomaxillofacial trauma on quality of life is supposed to be heinous but is still under reported. Also, cervical spine injuries are often missed in unconscious patients and other injuries are often dealt with, which often leads to fatal outcome. Traumatic

spine and Craniomaxillofacial injuries are underreported in India, and this study aims to find the association of the injuries and their individual characteristics with respect to the aetiology of trauma, treatment plan and its timing, and outcome, both short term and long term of these patients in Central India. This study will also help increasing the life expectancy of polytrauma patients in India and globally.

9.13 Ethical Issues

Patient will be evaluated and treated according to standard treatment guidelines and no new or invasive intervention is planned in this study.

10. Results

10.1 Demographic profile

10.1.1 Age and Mean age

Table 1: Incidence of age in group

Age in Group	Frequency	Percent
≤20	4	8.0%
21-30	18	36.0%
31-40	10	20.0%
41-50	9	18.0%
51-60	4	8.0%
61-70	3	6.0%
≥70	2	4.0%
Total	50	100.0%

In our study, 4 (8.0%) patients were ≤ 20 years of age, 18 (36.0%) patients were 21-30 years of age, 10 (20.0%) patients were 31-40 years of age, 9 (18.0%) patients were 41-50 years of age, 4 (8.0%) patients were 51-60 years of age, 3 (6.0%) patients were 61-70 years of age and 2 (4.0%) patients were ≥70 years of age.

Figure 1: Incidence of age in group

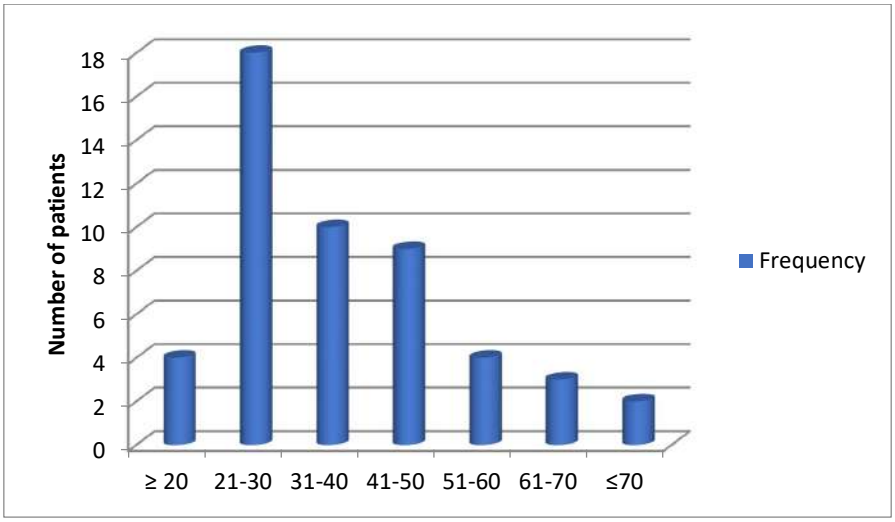
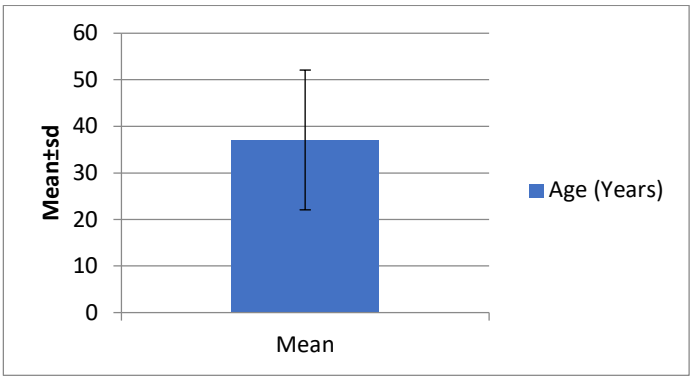


Table 2: Distribution of Mean age (years)

	Number	Mean	SD	Minimum	Maximum	Median
Age (Years)	50	37.1000	15.0201	18.0000	75.0000	34.0000

In above table, **Mean Age (Years) (Mean ± SD)** of patients was **37.1000 ± 15.0201**

Figure 2: Distribution of Mean age (years)



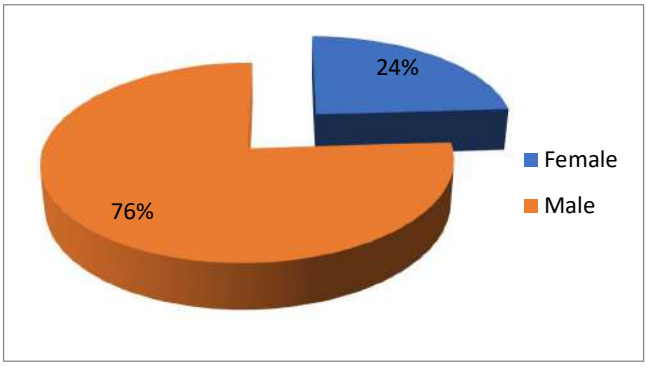
10.1.2 Gender

Table 3: Incidence of gender predominance

Gender	Frequency	Percent
Female	12	24.0%
Male	38	76.0%
Total	50	100.0%

In our study, 12 (24.0%) patients were Female and 38 (76.0%) patients were male.

Figure 3: Incidence of gender predominance



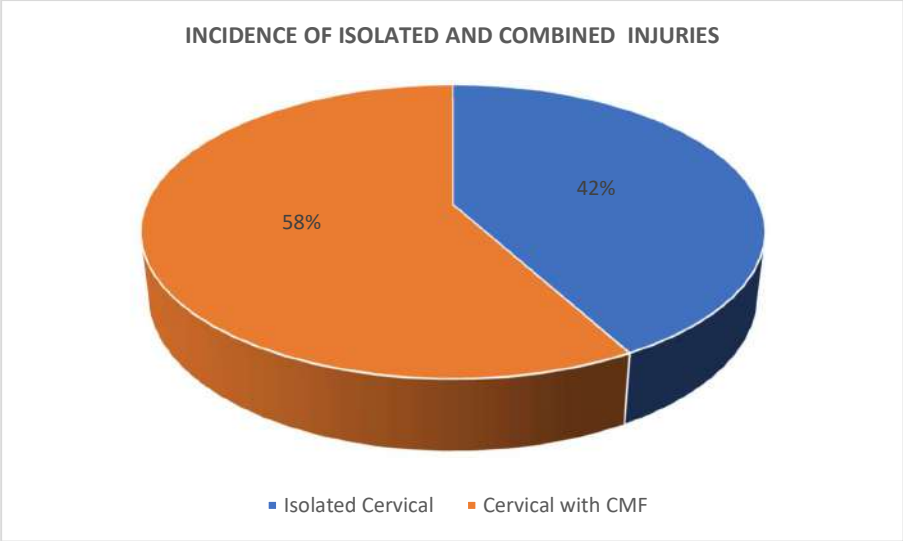
10.1.3 Incidence

10.1.3.1 Incidence of isolated cervical and combined injuries

Table 4: Incidence of isolated cervical and combined injuries

SITES	FREQUENCY	PERCENTAGE
Isolated Cervical	21	42.00%
Cervical with CMF	29	58.00%

Figure 4: incidence of isolated cervical and combined injuries



10.1.3.2 Incidence of cervical spine injury at each level

Table 5: Incidence of CT Spine level - C1

CT Spine Level - C1	Frequency	Percent
No	48	96.0%
Yes	2	4.0%
Total	50	100.0%

In our study, 2 (4.0%) patients had CT Spine Level - C1.

Table 6: Incidence of CT spine level - C2

CT Spine Level - C2	Frequency	Percent
No	41	82.0%
Yes	9	18.0%
Total	50	100.0%

In our study, 9 (18.0%) patients had CT Spine Level - C2.

Table 7: Incidence of CT spine level - C3

CT Spine Level - C3	Frequency	Percent
No	40	80.0%
Yes	10	20.0%
Total	50	100.0%

In our study, 10 (20.0%) patients had CT Spine Level - C3.

Table 8: Incidence of CT spine level - C4

CT Spine Level - C4	Frequency	Percent
No	37	74.0%
Yes	13	26.0%
Total	50	100.0%

In our study, 13 (26.0%) patients had CT Spine Level - C4.

Table 9: Incidence of CT spine level - C5

CT Spine Level - C5	Frequency	Percent
No	20	40.0%
Yes	30	60.0%
Total	50	100.0%

In our study, 30 (60.0%) patients had CT Spine Level - C5.

Table 10: Incidence of CT spine level - C6

CT Spine Level - C6	Frequency	Percent
No	27	54.0%
Yes	23	46.0%
Total	50	100.0%

In our study, 23 (46.0.0%) patients had CT Spine Level - C6.

Table 11: Incidence of CT spine level - C7

CT Spine Level - C7	Frequency	Percent
No	42	84.0%
Yes	8	16.0%
Total	50	100.0%

In our study, 8 (16.0%) patients had CT Spine Level - C7

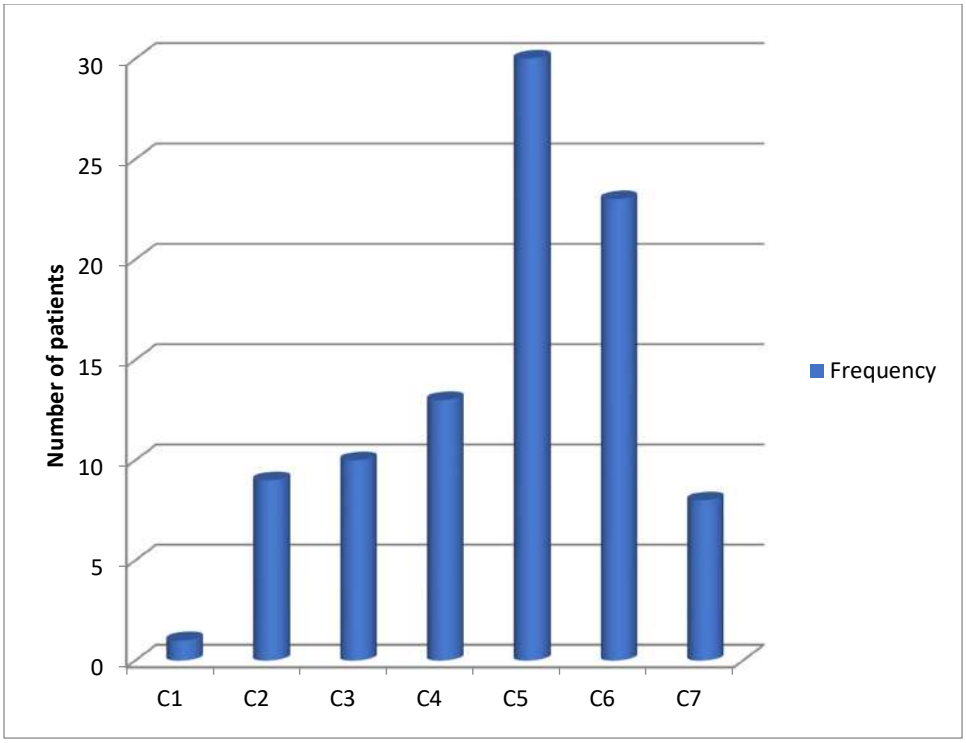
10.1.3.3 Distribution of CT spine level

Table 12: Distribution of CT spine level

CT SPINE LEVEL	Frequency	Percent
C1	1	1.1%
C2	9	9.6%
C3	10	10.6%
C4	13	13.8%
C5	30	31.9%
C6	23	24.5%
C7	8	8.5%
Total	94	100.0%

In our study, 1 (1.1%) patient had C1 CT spine level, 9 (9.6%) patients had C2 CT spine level, 10 (10.6%) patients had C3 CT spine level, 13 (13.8%) patients had C4 CT spine level, 30 (31.9%) patients had C5 CT spine level, 23 (24.5%) patients had C6 CT spine level and 8 (8.5%) patients had C7 of CT spine level.

Figure 5: Distribution of CT Spine levels

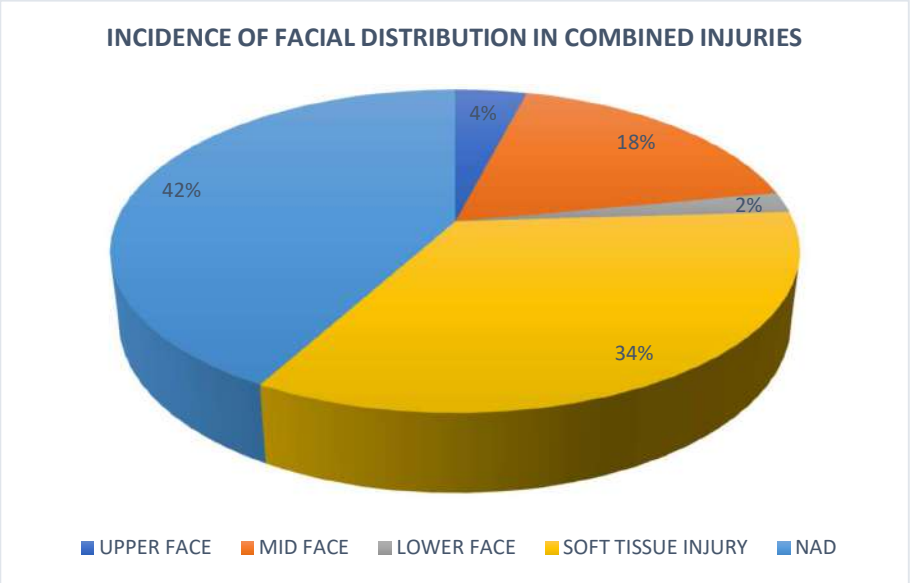


10.1.3.4 Incidence of facial distribution in combined injuries

Table 13: Incidence of facial distribution in combined injuries

SITES	FREQUENCY	PERCENTAGE
UPPER FACE	2	4.00%
MID FACE	9	18.00%
LOWER FACE	1	2.00%
SOFT TISSUE INJURY	17	34.00%
NAD	21	42.00%

Figure 6: incidence of facial distribution in combined injuries



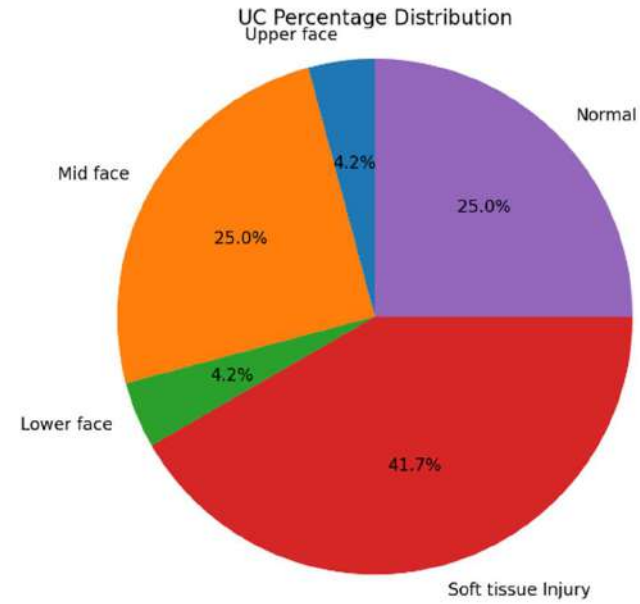
10.1.3.5 Association between cervical injury level and facial injury distribution

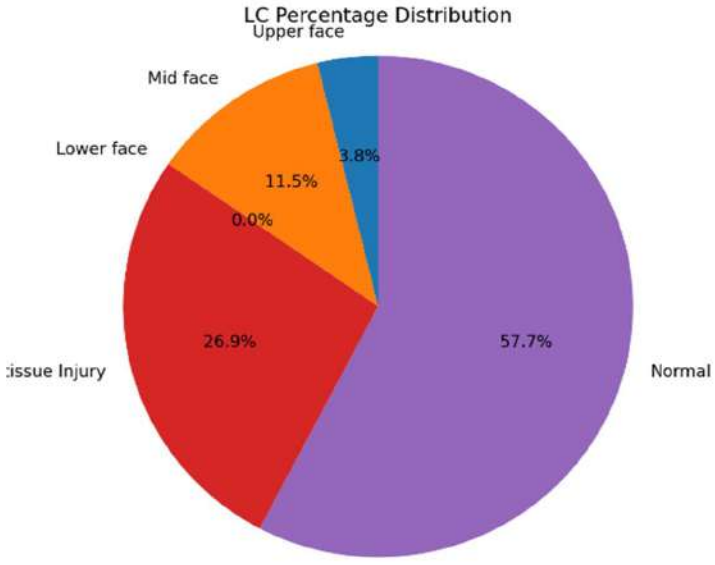
Table 14: Association between cervical injury level and facial injury distribution

	UPPER FACE	MID FACE	LOWER FACE	SOFT TISSUE INJURY	NORMAL
LC (LOWER CERVICAL)	1 (3.8%)	3 (11.5%)	0	7 (26.9%)	15 (57.7%)
UC (UPPER CERVICAL)	1 (4.2%)	6 (25.0%)	1 (4.2%)	1 (41.7%)	6 (25.0%)
Chi-square 6.32 p-value 0.18.					

This suggests that there is no statistically significant association between the categories in this dataset at the usual significance levels

Figure 7: Association between cervical injury level and facial injury distribution





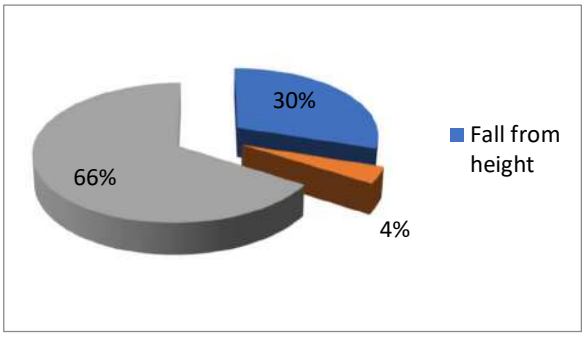
10.1.3.6 Incidence of mode of injury

Table 15: Incidence of mode of injury

Mode Of Injury	Frequency	Percent
Fall from height	15	30.0%
Fall of heavy object onto head	2	4.0%
RTA	33	66.0%
Total	50	100.0%

In our study, 15 (30.0%) patients had fall from height, 2 (4.0%) patients had fall of heavy object onto head and, 33 (66.0%) patients had RTA,

Figure 8: Incidence of mode of injury



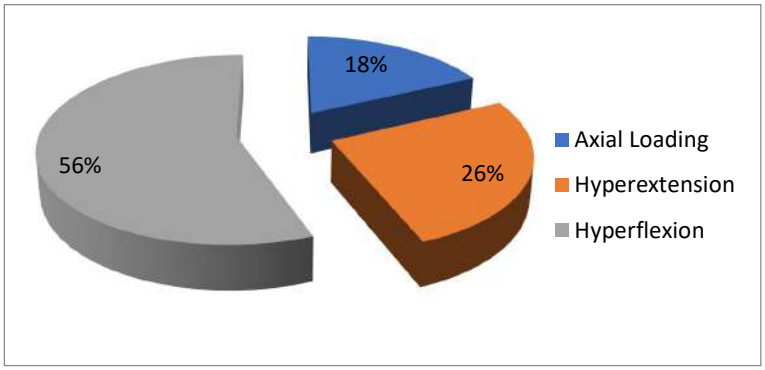
10.1.3.7 Incidence of mechanism of injury

Table 16: Incidence of mechanism of injury

Mechanism	Frequency	Percent
Axial Loading	9	18.0%
Hyperextension	13	26.0%
Hyperflexion	28	56.0%
Total	50	100.0%

In our study, 9 (18.0%) patients had Axial Loading, 13 (26.0%) patients had Hyperextension and, 28 (56.0%) patients had Hyperflexion.

Figure 9: Incidence of mechanism of injury



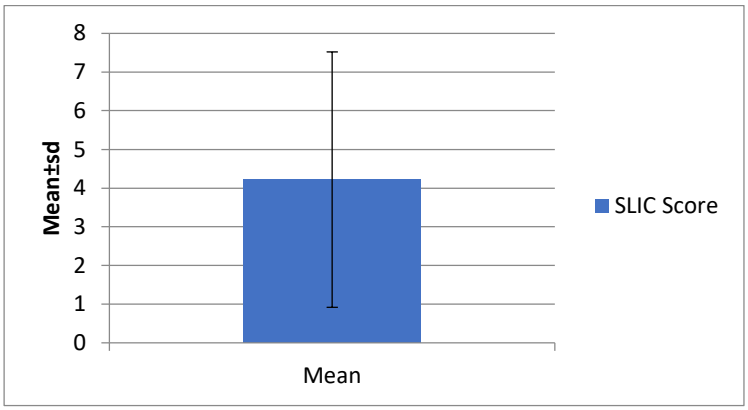
10.1.4 Mean SLIC score

Table 17: Distribution of mean SLIC score

	Number	Mean	SD	Minimum	Maximum	Median
SLIC Score	50	4.2200	3.3030	0.0000	9.0000	4.0000

In above table, the **Mean SLIC Score** (Mean ± SD.) of patients was **4.2200± 3.3030**

Figure 10: Distribution of mean SLIC score



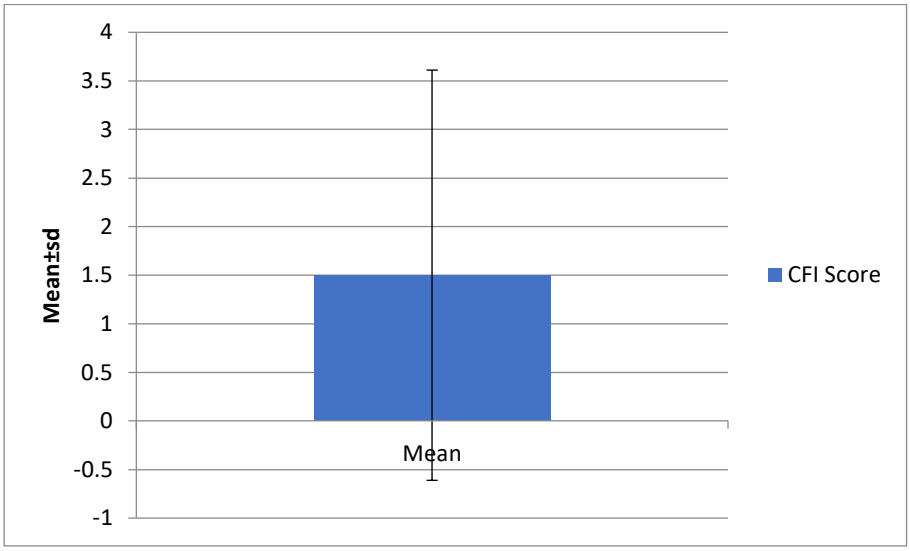
10.1.5 Mean CFI score

Table 18: Distribution of mean CFI score

	Number	Mean	SD	Minimum	Maximum	Median
CFI Score	50	1.5000	2.1117	0.0000	8.0000	1.0000

In above table, the **Mean CFI Score** (Mean ± SD.) of patients was **1.5000± 2.1117**

Figure 11: Distribution of mean CFI score



10.2 Clinical Presentation

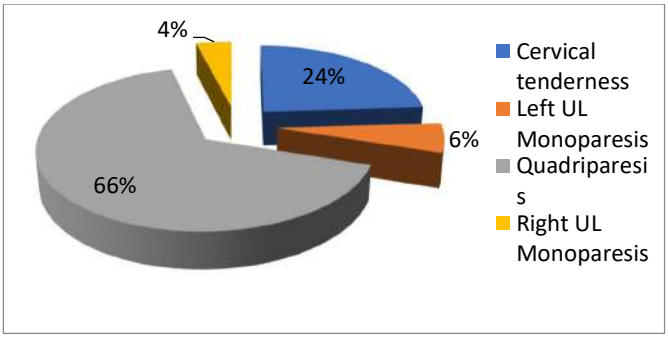
10.2.1 Neurological deficit

Table 19: Incidence of neurological deficit

C/F Of Cervical	Frequency	Percent
Cervical tenderness	12	24.0%
Left UL Monoparesis	3	6.0%
Quadriparesis	33	66.0%
Right UL Monoparesis	2	4.0%
Total	50	100.0%

In our study, 12 (24.0%) patients had cervical tenderness, 3 (6.0%) patients had Left UL Monoparesis, 33 (66.0%) patients had Quadriparesis and, 2 (4.0%) patients had Right UL Monoparesis.

Figure 12: Incidence of neurological deficit



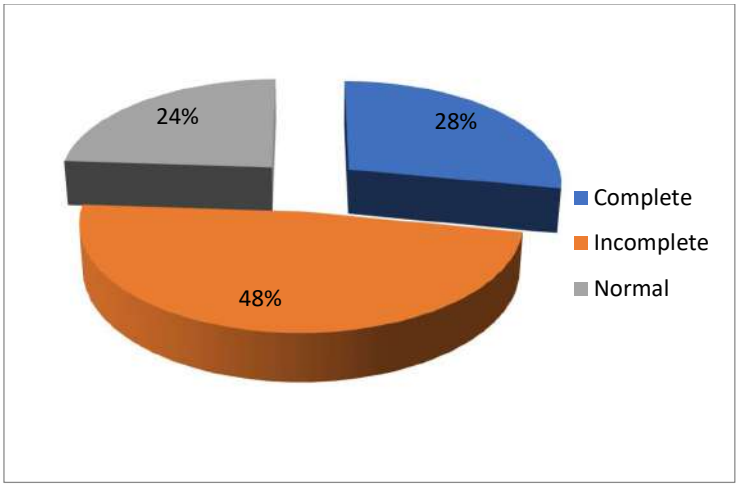
10.2.2 ASIA at presentation

Table 20: Incidence of ASIA at presentation

ASIA	Frequency	Percent
Complete (ASIA A)	14	28.0%
Incomplete (ASIA B, C, D)	24	48.0%
Normal (ASIA E)	12	24.0%
Total	50	100.0%

In our study, 14 (28.0%) patients had Complete ASIA, 24 (48.0%) patients had Incomplete ASIA, and 12 (24.0%) patients had ASIA Normal

Figure 13: Incidence of ASIA at presentation



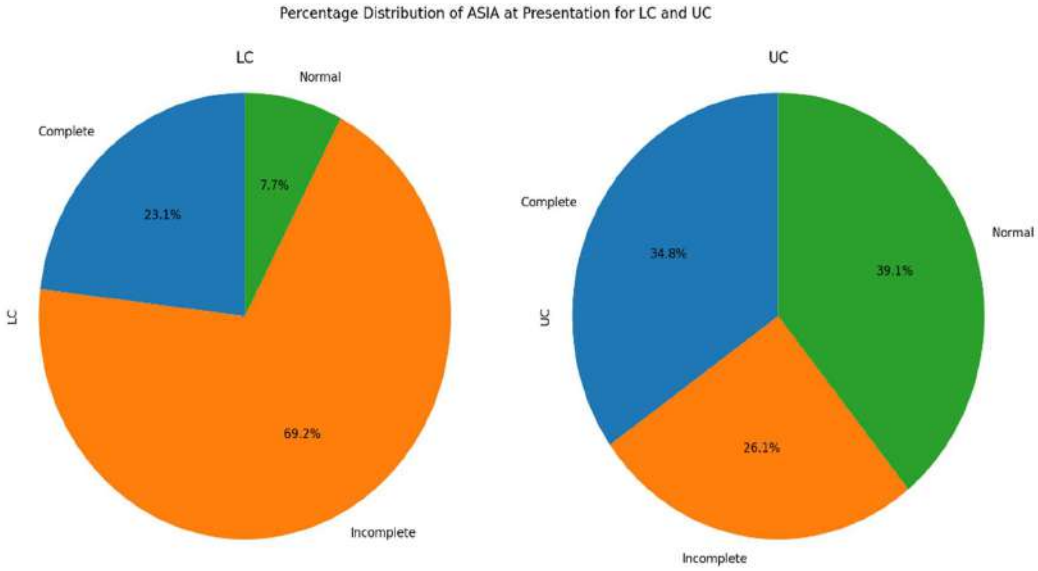
10.2.3 Association between cervical injury level and ASIA at presentation

Table 21: Association between cervical injury level and ASIA at presentation

	Complete (ASIA A)	Incomplete (ASIA B, C, D)	Normal (ASIA E)
LC (LOWER CERVICAL)	6 (23.07%)	18 (69.23%)	2 (7.69%)
UC (UPPER CERVICAL)	8 (34.78%)	6 (26.08%)	9 (39.13%)
Chi-square statistic: 10.59 p-value: 0.005			

The low p-value (0.005) suggests a **significant association** between CT spine level and ASIA at presentation.

Figure 14: Association between cervical injury level and ASIA at presentation



10.3 Management

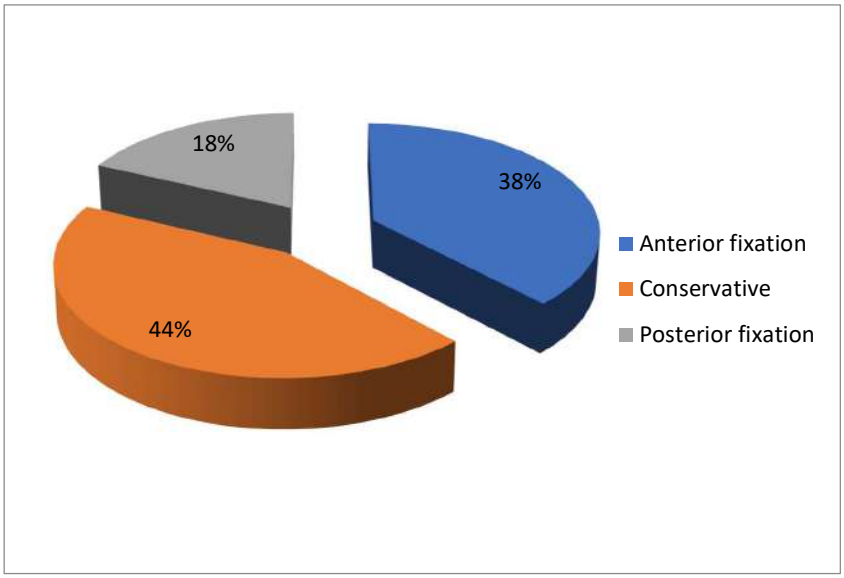
10.3.1 Management done for Cervical spine Injury

Table 22: Management done for Cervical spine Injury

Spinal Procedure	Frequency	Percent
Anterior fixation	19	38.0%
Conservative	22	44.0%
Posterior fixation	9	18.0%
Total	50	100.0%

In our study, 19 (38.0%) patients had anterior fixation, 22 (44.0%) patients had Conservative and 9 (18.0%) patients had Posterior fixation.

Figure 15: Spinal procedure done for Cervical spine Injury



10.4 Outcome

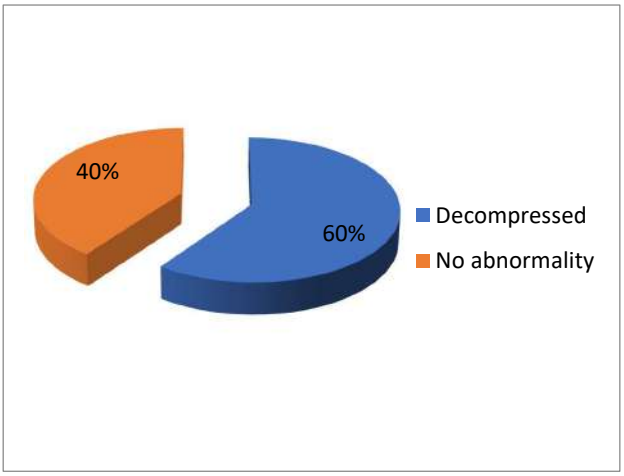
10.4.1 Radiological Outcome

Table 23: Radiological outcome (NCCT)

Radiological Outcome (NCCT)	Frequency	Percent
Decompressed	30	60.0%
No abnormality	20	40.0%
Total	50	100.0%

In our study, in 30 (60.0%) patients, adequate decompression was done

Figure 16: Radiological outcome (NCCT)



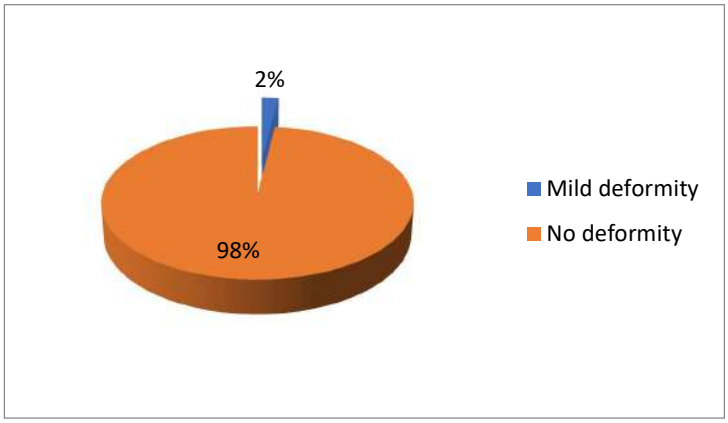
10.4.2 Craniomaxillofacial outcome

Table 24: Craniomaxillofacial outcome

CMF Outcome	Frequency	Percent
Mild deformity	1	2.0%
No deformity	49	98.0%
Total	50	100.0%

In our study, 1 (2.0%) patient had Mild deformity.

Figure 17: Craniomaxillofacial outcome



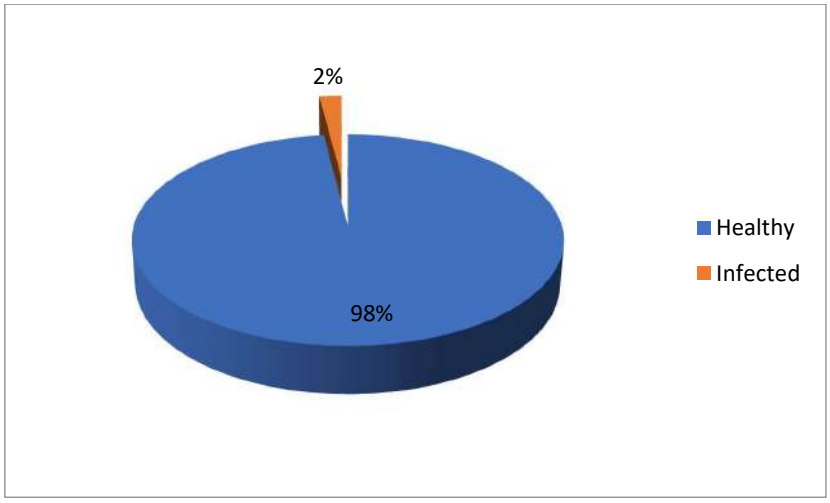
10.4.3 Postoperative wound status

Table 25: Postoperative wound status

Wound Status	Frequency	Percent
Healthy	49	98.0%
Infected	1	2.0%
Total	50	100.0%

In our study, 49 (98.0%) patients had Healthy Wound. And 1 (2.0%) had infected wound

Figure 18: Postoperative wound status



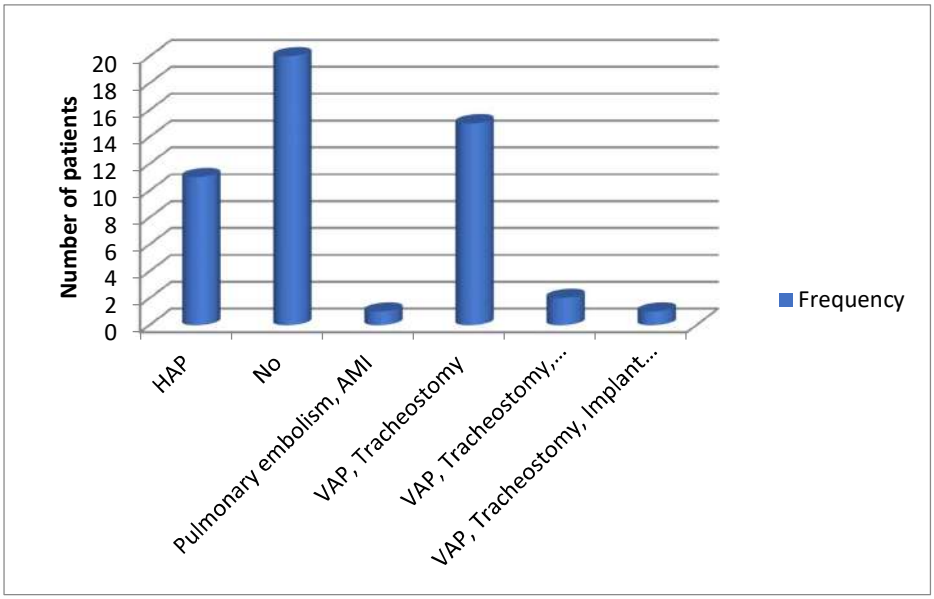
10.4.4 Post operative ICU complications

Table 26: Post op ICU complications

Post Op Complications	Frequency	Percent
HAP	11	22.0%
No	20	40.0%
Pulmonary embolism, AMI	1	2.0%
VAP, Tracheostomy	15	30.0%
VAP, Tracheostomy, Bronchoscopy	2	4.0%
VAP, Tracheostomy, Implant displacement	1	2.0%
Total	50	100.0%

In our study, 11 (22.0%) patients had HAP Post Op Complications, 1 (2.0%) patient had pulmonary embolism, AMI Post Op Complications, 15 (30.0%) patients had VAP, Tracheostomy Post Op Complications, 2 (4.0%) patients had VAP, Tracheostomy, Bronchoscopy and 1 (2.0%) patient had VAP, Tracheostomy, Implant displacement.

Figure 19: Post op ICU complications



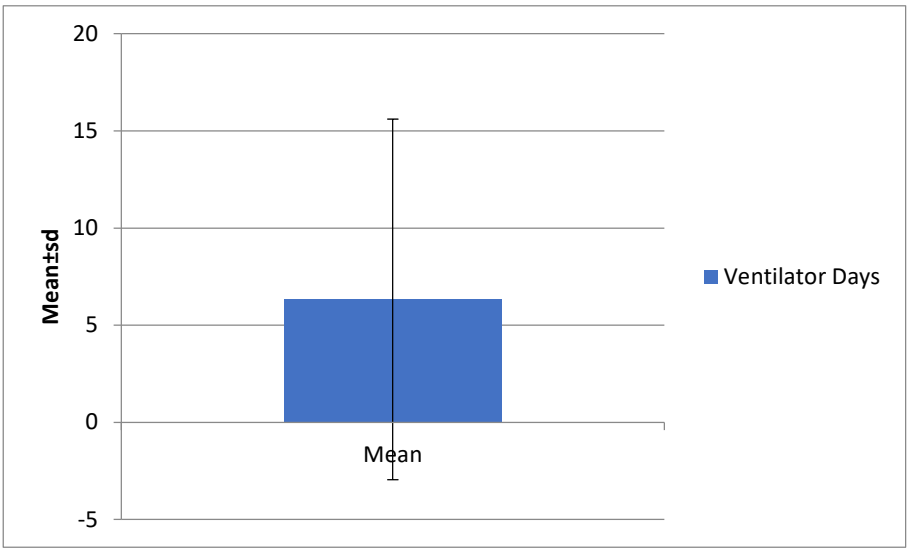
10.4.5 Mean ventilator days

Table 27: Mean ventilator days

	Number	Mean	SD	Minimum	Maximum	Median
Ventilator Days	50	6.3200	9.2812	0.0000	35.0000	0.0000

In above table, **Mean Ventilator Days** (Mean ± SD) of patients was **6.3200± 9.2812**

Figure 20: Mean ventilator days



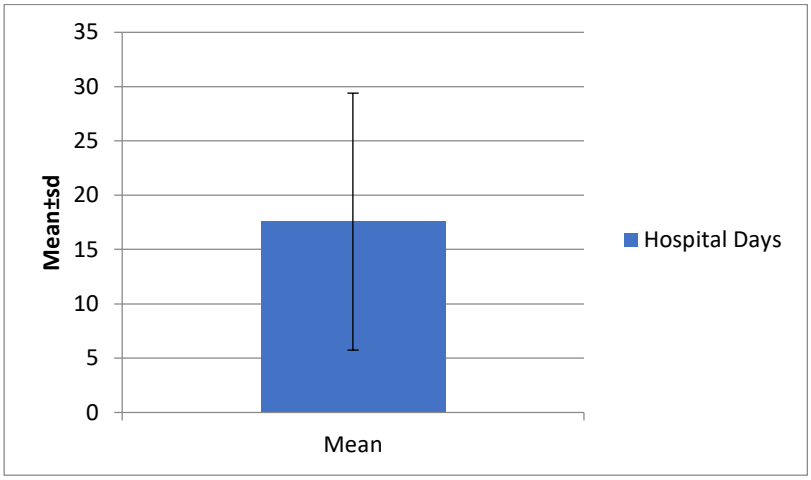
10.4.6 Mean hospital days

Table 28: Mean hospital days

	Number	Mean	SD	Minimum	Maximum	Median
Hospital Days	50	17.5800	11.8254	2.0000	50.0000	15.0000

In above table, **Mean Hospital Days** (Mean ± SD) of patients was **17.5800± 11.8254**

Figure 21: Mean hospital days



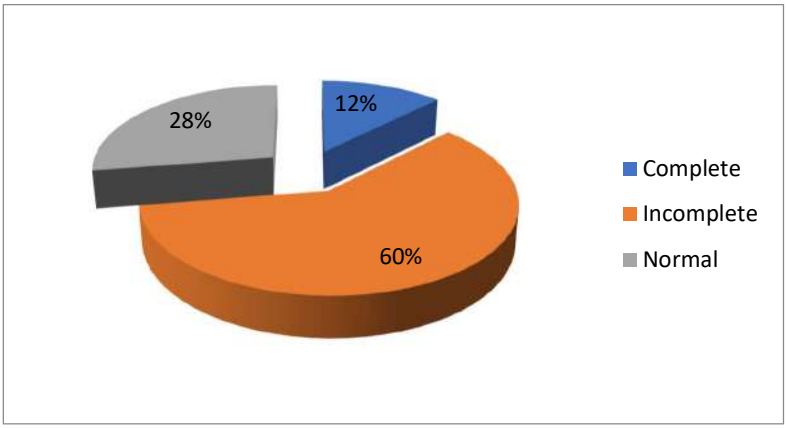
10.4.7 ASIA at discharge

Table 29: ASIA at discharge

Asia At Discharge	Frequency	Percent
Complete	5	12.5%
Incomplete	24	60.0%
Normal	11	27.5%
Total	40	100.0%

In our study, 5 (12.5%) patients had Complete Asia at Discharge, 24 (60.0%) patients had Incomplete Asia at Discharge and 11 (27.5%) patients had Normal Asia at Discharge.

Figure 22: ASIA at discharge



10.5 Follow up

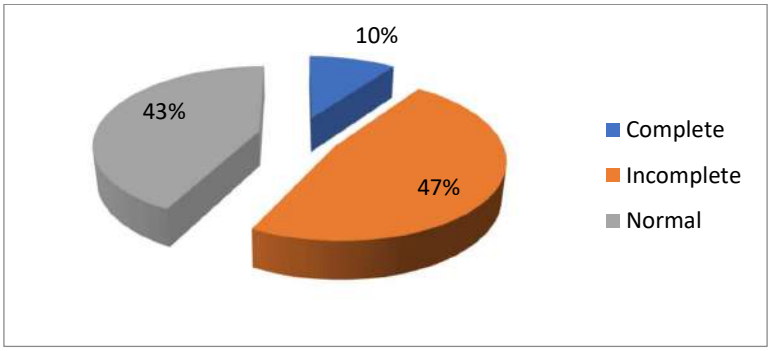
10.5.1 ASIA at 1 month

Table 30: ASIA at 1 month

Asia At 1 Month	Frequency	Percent
Complete	4	10.0%
Incomplete	19	47.5%
Normal	17	42.5%
Total	40	100.0%

In our study, 4 (10.0%) patients had Complete Asia at 1 Month, 19 (47.5%) patients had Incomplete Asia at 1 Month and 17 (42.5%) patients had Normal Asia at 1 Month.

Figure 23: ASIA at 1 month



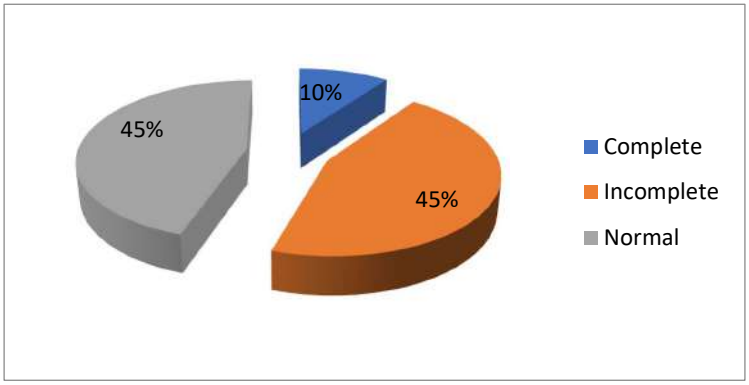
10.5.2 ASIA at 3 months

Table 31: ASIA at 3 months

ASIA AT 3 MONTHS	Frequency	Percent
Complete	4	10.0%
Incomplete	18	45.0%
Normal	18	45.0%
Total	40	100.0%

In our study, 4 (10.0%) patients had Complete Asia at 3 Months, 18 (45.0%) patients had Incomplete Asia at 3 Months and 18 (45.0%) patients had Normal Asia At 3 Months.

Figure 24: ASIA at 3 months



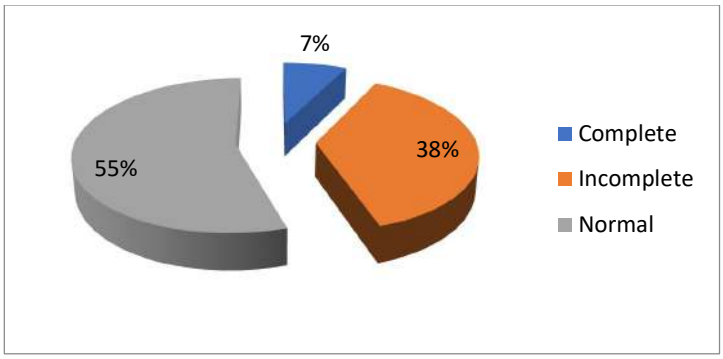
10.5.3 ASIA at 6 months

Table 32: ASIA at 6 months

Asia At 6 Months	Frequency	Percent
Complete	3	7.5%
Incomplete	15	37.5%
Normal	22	55.0%
Total	40	100.0%

In our study, 3 (7.5%) patients had Complete Asia at 6 Months, 15 (37.5%) patients had Incomplete Asia at 6 Months and 22 (55.0%) patients had Normal Asia at 6 Months.

Figure 25: ASIA at 6 months



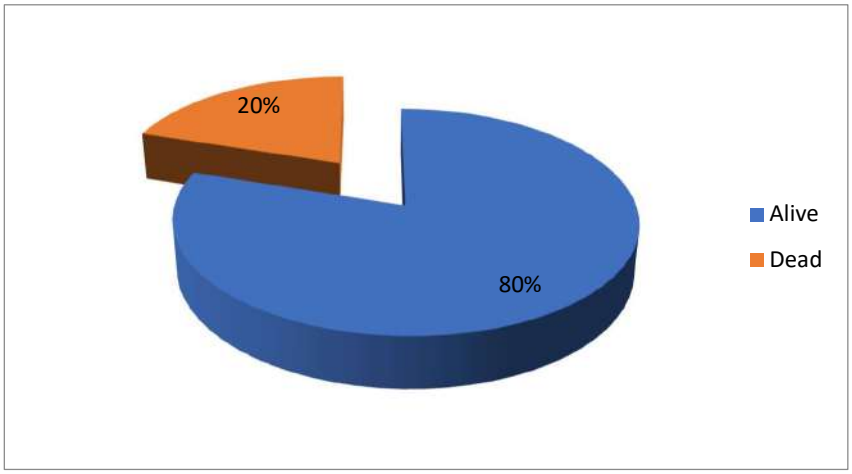
10.5.4 Mortality

Table 33: Mortality

Mortality	Frequency	Percent
Alive	40	80.0%
Dead	10	20.0%
Total	50	100.0%

In our study, 40 (80.0%) patients had Alive, 10 (20.0%) patients had Dead.

Figure 26: Mortality



10.5.5 Association between ASIA score and mortality

Table 34: Association between ASIA score and mortality

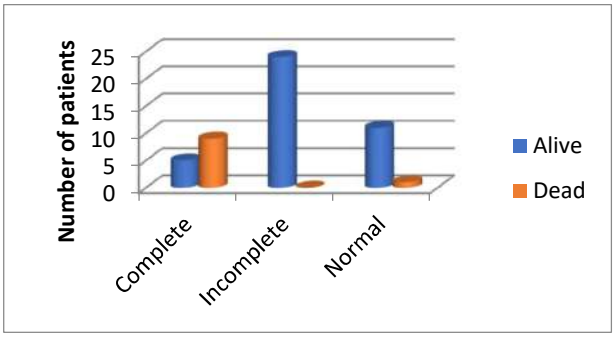
Mortality			
Asia	**Alive**	**Dead**	**Total**
Complete	5	9	14
Row %	35.7	64.3	100.0
Col %	12.5	90.0	28.0
Incomplete	24	0	24
Row %	100.0	0.0	100.0
Col %	60.0	0.0	48.0
Normal	11	1	12
Row %	91.7	8.3	100.0
Col %	27.5	10.0	24.0
Total	40	10	50
Row %	80.0	20.0	100.0
Col %	100.0	100.0	100.0
Chi-square value: 24.1815; p-value: <0.0001			

In Alive Group, 5 (12.5%) patients had Asia Complete, 24 (60.0%) patients had Asia Incomplete and 11 (27.5%) patients had Asia Normal

In Dead, Group, 9 (90.0%) patients had Asia Complete, and 1 (10.0%) patient had Asia Normal

Association of Asia with Mortality was statistically significant ($p<0.0001$).

Figure 27: Association between ASIA score and mortality



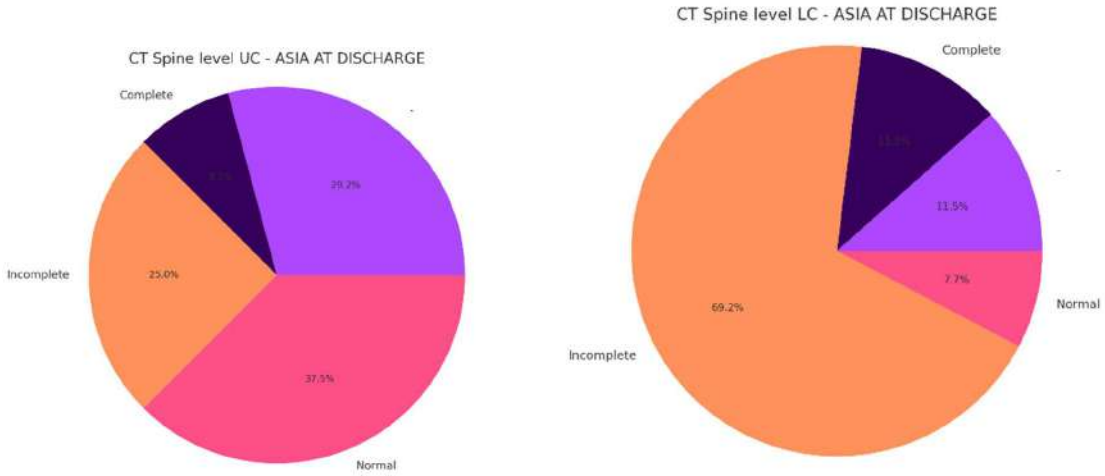
10.6 Association between cervical injury level and clinical outcome

10.6.1 ASIA at Discharge

Table 35: ASIA at Discharge

CT Spine level	Dead	Complete	Incomplete	Normal
LC LOWER CERVICAL	3 (11.5%)	3 (11.5%)	18 (69.2%)	2 (7.6%)
UC UPPER CERVICAL	7 (29.1%)	2 (8.3%)	6 (25%)	9 (37.5%)
Chi square 12.19 P value 0.0067				

Figure 28: ASIA at Discharge

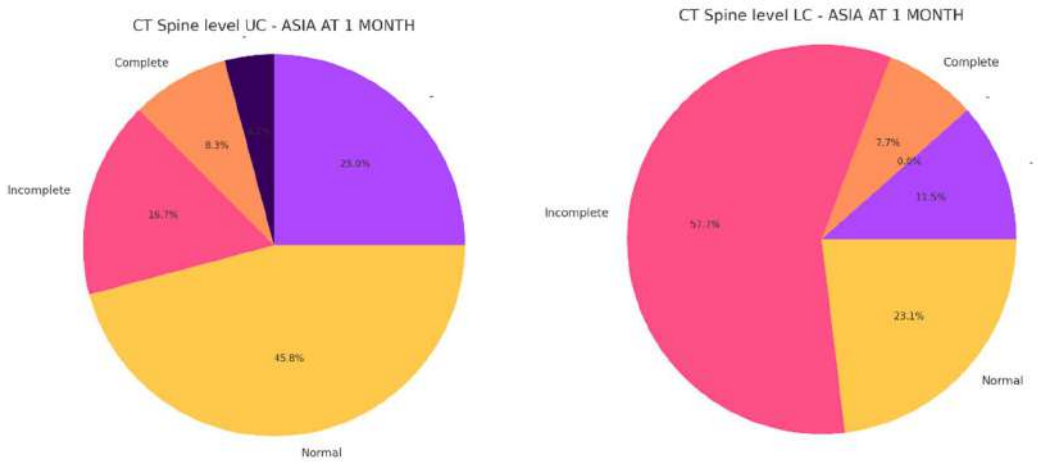


10.6.2 ASIA at 1 month

Table 36: ASIA at 1 month

CT Spine level	Dead	Complete	Incomplete	Normal
LC LOWER CERVICAL	3 (11.5%)	2 (7.6%)	15 (57.6%)	6 (23.0%)
UC UPPER CERVICAL	7 (29.1%)	2 (8.3%)	4 (16.6%)	11 (45.8%)
Chi square 9.77 P value 0.0444				

Figure 29: ASIA at 1 month

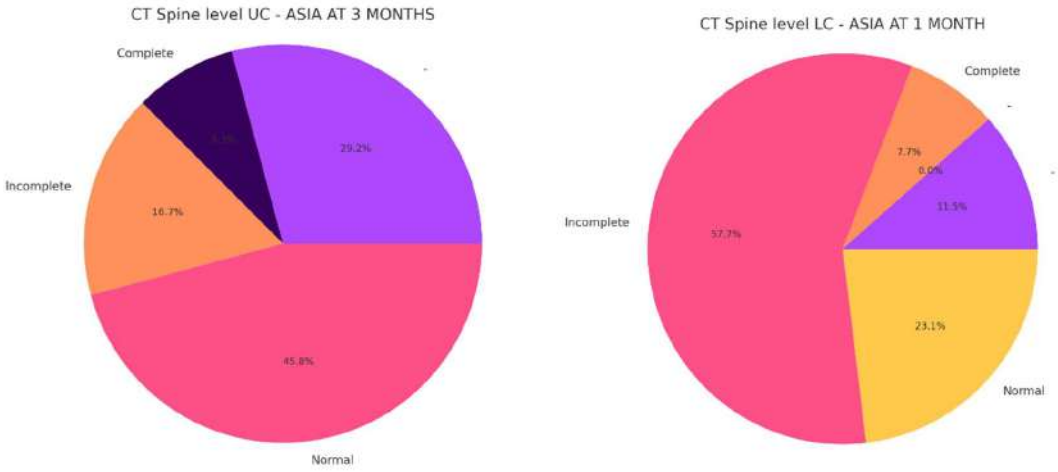


10.6.3 ASIA at 3 months

Table 37: ASIA at 3 months

CT Spine level	Dead	Complete	Incomplete	Normal
LC LOWER CERVICAL	3 (11.5%)	2 (7.6%)	14 (53.8%)	7 (26.9%)
UC UPPER CERVICAL	7 (29.1%)	2 (8.3%)	4 (16.6%)	11 (45.8%)
Chi square 7.98 P value 0.0465				

Figure 30: ASIA at 3 months

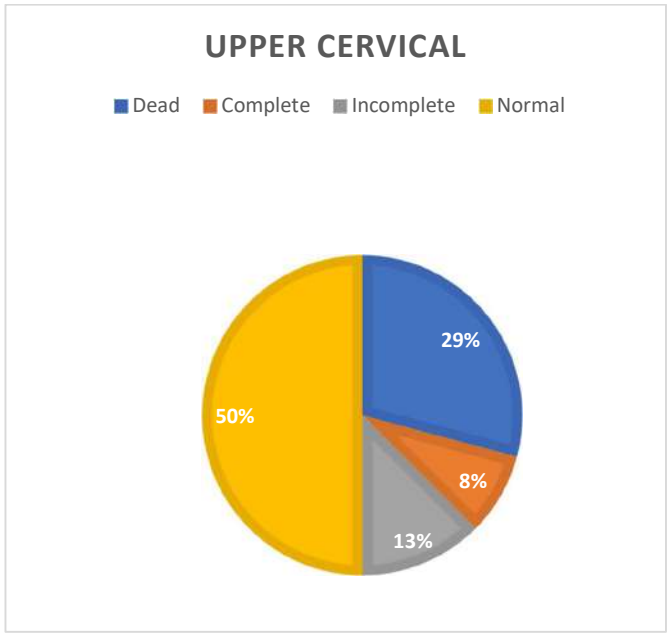


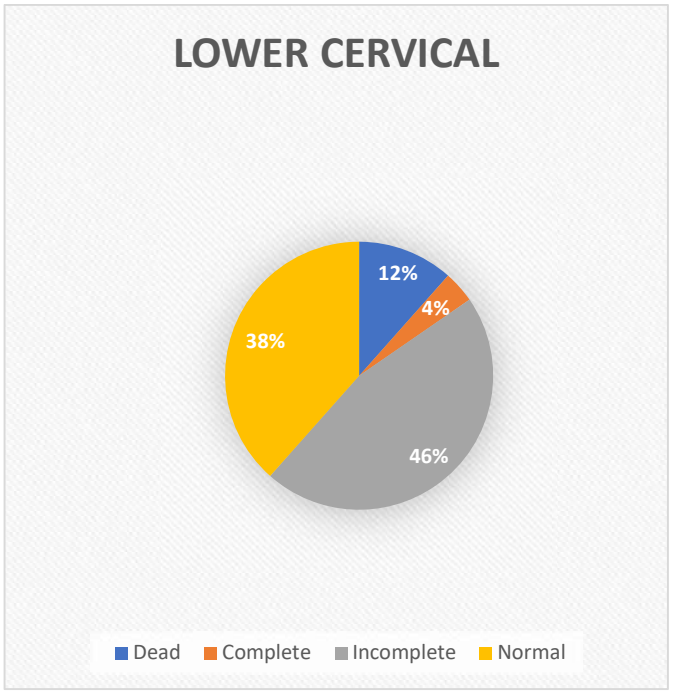
10.6.4 ASIA at 6 months

Table 38: ASIA at 6 months

CT Spine level	Dead	Complete	Incomplete	Normal
LC LOWER CERVICAL	3 (11.5%)	1 (3.8%)	12 (46.1%)	10 (38.4%)
UC UPPER CERVICAL	7 (29.1%)	2 (8.3%)	3 (12.5%)	12 (50%)
Chi square 7.45 P value 0.05				

Figure 31: ASIA at 6 months





11. Discussion

Road accidents are a major cause of morbidity and mortality. The face, being the most visible part of our body, often gets hurt in these incidents. Patients with facial injuries usually have other injuries too, especially to their heads and necks. It's a common thought that if someone has facial trauma, doctors should check for neck injuries until they prove there aren't any. Recently, a study by **Jamal et al.**[46] and others backed this idea. According to the World Health Organization (WHO), India has some of the highest rates of road accidents worldwide. So, it's really important to look into how neck injuries & facial injuries might be connected. When there is neck injuries involved, treatments can change. This may also delay fixing facial fractures. However, we can reduce delays by getting a neurosurgeon involved early on. They help stabilize neck injuries. Also, when doctors put patients under anaesthesia for surgery, they need to be very careful. Using endoscopic guidance for intubation can help avoid moving the head too much.

This study aims to look closely at how maxillofacial injuries relate to cervical spine injuries. We want to understand why these combined injuries happen, profile the patients better, and examine patterns of facial fractures. Furthermore, we'll consider levels of cervical spine injury and what management options work best. We will also look at outcomes with ASIA scores, ICU complications, and overall mortality rates. All this information can smooth out treatment paths and improve recovery for patients.

11.1 Cervical spine injury and aetiology of trauma

Jamal BT et al.[46] in 2009 reported that falls were the leading cause of cervical spine injuries with maxillofacial fractures.

Contrary to the old belief, **Mubeen et al**[47] in 2023 reported that the chances of cervical injuries related with facial fractures rises when caused by **high-speed incidents**, such as car accidents. This was explained by the fact that the maxillofacial area receives more force from the impact of trauma than it got transmitted to the neck.

Subhasraj *et al.*[48] in 2007 also studied 2748 maxillofacial injury patients in Chennai and he reported an incidence of 62% of injuries from two wheelers and 23 % from four wheelers in Indian roads, respectively.

Keita *et al*.[49] in 2010 with 184 patients in Mali, found 93% road traffic accidents causing maxillofacial injuries. This can be attributed to local conditions like bad roads and lack of restraints, hence road traffic accidents proved to be the most common cause for maxillofacial injuries and cervical spine injuries.

Hackl et al[50] during a period of 4 years (1995 to 1998) with 3083 patients, reported that traffic accidents accounted for 43.7% of combined facial and cervical spine injuries.

Mukherjee et al in his 6 year retrospective analysis in UK, reported that 88% of CSI cases were associated with trauma with a fourfold higher incidence of concomitant injuries due to RTA than due to fall from height.

Our study found a 66% association of RTA with combined Cervical and Craniomaxillofacial injuries whereas 30% resulted due to fall from height – indicating double the percentage. The increase in association of CSI with RTAs (as opposed to falls and other traumatic incidents) is explained by the greater velocity and resultant force of impact to the face and force is the product of mass and acceleration. This traumatic force is transmitted through the facial skeleton into the cervical spine, causing spinal cord injury. Times when patient is not wearing a seatbelt and he is subjected to indirect cervical spine injury as his head easily gets hyperflexed or hyperextended by the force of impact with either windshield, steering wheel or other structures inside the vehicle.

11.2 Age

Mubeen et al[47], in a study of 120 maxillofacial injury patients in 2023 reported the mean age of 27.21 ± 9.9 with a 64.7 percent of patients are in the 40 to 45 age range.

Isfahan et al[23] in a prospective cohort of 124 patients in 2014 reported most of the patients with combined cervical and facial injuries fell in the range of 21-40.

Alexander et al[51] in a retrospective study with 12329 patients reporting at a trauma centre at Kasturba Hospital in Manipal during a 5-year period (January 1, 1995 to December 31, 1999) with facial fractures and cervical injuries found the ages of the patients ranging from 7 to 70 years with mean age being 32 years.

Ugboko et al[52] in a retrospective review of 442 patients, saw that approximately 72% of the patients sustained fractures from road traffic accidents and 39% of the fractures occurred in the 21-30-year range with a a male preponderance.

Haug et al[25] in 1990, in a 5-year review of facial fractures and concomitant cervical injuries at a level 1 trauma centre, reported that the majority of facial fractures were found in males; the most prevalent age range being 16 to 30 years.

Hogg et al[53] in a retrospective study of 2969 patients from Ontario Trauma Registry found the median age to be 25 years, and men injured at a 3:1 ratio over women.

Hackl et al[50] during a period of 4 years (1995 to 1998) with 3083 patients, reported that Facial trauma patients with concomitant cervical spine injuries were significantly older (mean age, 42 years) with a female/male ratio of 30:70.

Our study found 36% patients in the range of 21-30 years, similar to other studies conducted in the recent past with minimum % <20 and >70 years. The mean age of the patients was found to be 37.1000 ± 15.0201.

11.3 Gender predominance

Males outnumbered females in our review with 76% males and 24 % females – a ratio of 3:1. This finding coincides with other studies that reported a male female ratio of 2.7:1 (**Obuekwe and Etetafia, 2004**)[26], 6:1 (**Hussain et al., 2003**)[54], and 1.74:1 (**Li et al., 2015**)[55].

Higher incidence of males is explained by higher involvement in outdoor activities, lack of awareness of necessary preventions, higher involvement in sport activities, and higher availability of weapons (**Boffano et al., 2014**)[30].

11.4 Incidence of maxillofacial fractures in patients of cervical spine injuries

Numerous researches have been done recently, but the prevalence of combined CSI and CMF injuries in each study differs. The majority of these studies concentrated on certain fracture

types, such as those of the mandible or maxilla, or on a grouping of all craniomaxillofacial fractures.

Mubeen et al[47] found a 3.3% incidence of combined cervical and maxillofacial fractures, quite similar findings from earlier studies (0% to 4.3%).

Bicsak et al[56] found 2.47% of all MFI patients were diagnosed with a concomitant CSI. This is comparable with the literature but is lower than the international average (0.8% to 12%). This incidence percentage is quite less than what was reported by **Pietzka et al**. in the German registry study (11.3%) or single instituition studies from the USA and UK, but Roccia et al from Italy reported more than 0.8% incidence.

Mukherjee et al, in his 6-year retrospective analysis on 714 patients with maxillofacial fractures reported that 56% of patients with Cervical spine injuries had a combined maxillofacial fracture pattern. These findings likely reflect that patient with cervical spine injuries has a much higher association with maxillofacial fractures than the other way round. This is due to the fact that greater force of injury plays a significant role when two or more facial regions have been fractured in comparison to isolated facial region, which in turn gets transmitted to the cervical spine.

Our study focused on association of maxillofacial injuries in a population of cervical spine injuries and found that 58% of patients suffered concomitant craniomaxillofacial injuries with Cervical spine injuries.

11.5 Facial injury pattern in Cervical spine injuries

In relation to the location of the facial fracture, in their discussion of the standard cervical injury model, **Lalani et al** and **Bonanthaya at al**[24] discovered that injuries to the lower third of the face (mainly Mandible)are mostly associated with upper cervical spine injuries while midface fractures are more common with lower cervical spine trauma**.**

Bicsak et al[56] found that injuries located near to the cranial base (Mid face) both in central and in lateral areas of the facial skull are significantly associated with CSI than other regions of the face (87.7% cases). This level correlates approximately with the Frankfurt horizontal plane. Fractures in the Frankfurt plane cause grievous injuries of the Cervical spine, thus Bicsak et al. called this region of the face as "**Cervical Spine Injury Alert Bend**". After a

detailed analysis of these papers, a higher incidence of CSI is reported in more cranial fractures of the lower jaw, like fractures of the mandible. Their analysis of concomitant midfacial fractures and CSI provided a very similar result than our study.

Our study showed mid facial fractures more commonly associated with both Upper cervical and lower cervical injuries, more common in upper cervical (25%) than lower cervical (11.5%) and isolated mandible fractures more common with upper cervical injuries (4.2%) at the level of C2 and no patient had isolated mandible fracture with concomitant CSI.

The association of CSI incidence in combination with isolated mandibular fractures is much lower than the old belief. The mandible moves on its articular surface in relation to the glenoid fossa, hence force impact on the mandible is not transmitted directly to the cervical spine, unlike in case of middle and upper face fractures. This explanation supports the belief that the mandible dissipates the energy from impact and protects the head and neck from the trauma force of impact. Interestingly, and even conversely, **Chu et al**. reported that patients sustaining multiple mandibular fractures had fewer CSIs than patients with isolated mandibular fractures. The authors reported that the facial skeleton absorbs most of the transmitted energy and spreads it throughout the facial bones, transmitting a much lesser force to the cervical spine (**Chu et al., 2016**)[17]. Clayton et al. on the other hand, suggested that the cervical spine may be more commonly associated with inertial differences between the head and torso, as opposed to transmitted compression forces from head or facial trauma (**Clayton et al., 2012**). Both these explanations are relatable, but case wise differences will persist based on the corresponding trauma mechanism. Recently, **Farkkila et al.**[17] reported that isolated fractures of the mandibular ramus condyle unit are risk factors for increased CSI risk (**Farkkila et al., 2019**[17]). However, combined CSI and facial fractures significantly increases the risk. The important study by Chu et al. proposed that mandibular fractures are commonly associated with CSIs (Chu et al., 2016). However, in their study, they did not specify whether the exclusion criteria covered patients with concomitant facial fractures other than mandibular fractures. On the basis of these discrepancies, we propose that even though lower facial/ mandibular fractures incidences are quite significant in combination with head and neck injuries, association of isolated lower facial fractures with CSIs are much less reported than previously was believed.

Numerous publications have suggested midfacial fractures to be strongly associated with CSI **(Mukherjee et al.[18], 2015; Reich et al.[57], 2016; Mourouzis et al.[58], 2018; Xun et al.[59], 2019).**

Sajjad et al(**Rahman and Chandrasala, 2014**)[23] reported that the midface was the most common location of fractures that result in CSI following an MFT. Cervical spine injuries are significantly associated with mid face and lower facial fractures - this is explained by the possible relation of the upper cervical compartments with the mandible and the lower cervical compartments with the midface(**Lalani and Bonanthaya[24], 1997**).

11.6 Most common isolated Cervical level

CSI occur principally at two levels, C1/C2 and C5/C6/C7, accounting for almost 70% of all CSI. This finding is supported by **Elahi et al**, who showed that 67% of 124 CSIs associated with maxillofacial trauma occurred at the C1/C2 and C6/C7 levels. It is possibly explained by the fact that the loose articular capsules of the C1/C2 joint, together with shallow articular facets of the C1, produce the quite significant inherent instability of the cervical spine at C1-C2 joint, allowing approximately half of all its flexion, extension and rotational movement. This finding correlates with other studies which reported the C2 spine to be the most commonly involved vertebrae of the cervical spine (**McMordie et al., 2020, Menger et al., 2020**). The relatively greater degree of rotational movement permitted in the cervicothoracic junction at C5/C6/C7 may account for the higher frequency of injuries found at this level.

Our study found 10.7% CSI at C1/C2 level 66% incidence of CSI at C5/C6/C7 level with maximum at C5 (31.9%). Also, frequency of cervical disc herniation and cord contusion was more common in lower cervical injury level than in the upper cervical injury level. This difference may be due to accentuation of direct and indirect forces transmitted from the facial skeleton further down the spinal cord[60]. Another explanation asserts that the significant ligamentous anatomy of the C1/C2 region, compared with lower levels of the sub-axial cervical spine, serves to protect the spinal cord from injury. A further biomechanical mechanism states that the smaller diameter of the cervical spinal canal at C6/C7 versus that at C1/C2 is associated with an increased risk of cord injury.[61]

11.7 Comparative analysis of the Studies done over the period

Table 39: Comparative analysis of the Studies done over the period

Author/year	Mean age	Cause of combined MFT and CSI	Location of MFT	Location of CSI	Type of CSI	M:F ratio	MFT with CSI (%)	Total
Haug et al., 1991[25]	25 Years	MVA (91%)	Mandible (91%)	*	Subluxation	10.1:1	2	563
Lalani and Bonanthaya, 1997[24]	40 Years	MVA	*	C5-C7	Fracture with a neurological defect	7:1	3	536
Hackl et al., 2001[50]	42 Years	MVA (43.7%)	Midface	*	Sprain (whiplash injury)	2.3:1	6.7	2877
Mukherjee et al., 2015[18]	44 Years	MVA (88%)	Midface	C1-C2 C6-C7	Subluxation and dislocation	3:2	2.2	714
Kumar, 2017[62]	33 Years	MVA (46.15%)	Mandible	C2	*	1.49:1	100	169
Bayles et al., 1997[63]	32 Years	Assault (68.2%)	Mandible	C1-C8	Distracting injury	5.4:1	0.6	2121
Beirne et al., 1995[64]	*	Assault (43.9%)	Mid-Facie	C2-C4 C5-C7	Neck pain and discomfort	*	1.04	582
Färkkilä et al., 2019[65]	40	MVA	Mandible	C2	Fracture of the cervical spine	5.25:1	7.7	23,394
Chu et al., 2017[66]	*	Firearm (12.2%)	Mandible	*	*	**	10.8	59,028
Kumar et al., 2009[67]	96 Years	MVA 75%	Mandible and midface	C1-C2 C6-C7	*	2.3:1	2.24	714
Reich et al., 2016[57]	56.2 Years	MVA	Midface	C2	Dens Axis Anderson Type II	1.38:1	5.7	3956

Soumithran and Philip, 2007	*	MVA (66.6%)	Midface	*	*	*	1.07	4460
Mourouzis et al., 2018[58]	39.81 Years	MVA (77.3%)	Mandible zygomatic process	C6-C7	Transverse and spinous processes fracture	1.75:1	5.1	432
Jamal et al., 2009[46]	*	MVA (45.5%)	Orbit (27.3%)	C2	Single cervical fracture	1.27:1	6.28	701
Lewis et al., 1985[68]	*	MVA	Mandible	C5-C7	Subluxation and dislocation	2.7:1	19.3	982
Mulligan, 2010[69]	*	MVA	Mandible,	C5-C7	*	*	4.9 to 8.0 %	1.3 million
Davidson, 1989	*	MVA (85%)	*	C2 C5-C7	Cervical spine injuries Dislocation Subluxation	75% male	1.3%	2,555
Jonathan Zelken, 2014[70]	0–103	MVA (39%)	Mandible	C5-C7	Cervical spine injuries	77.6 Male	6.6%	4398
Mithani et al., 2009[71]	35	MVA	Nasal Bone	*	Fracture/Dislocation	Male	9.7%	4786

12. Limitations of the study

This study was done in a single institution. It's an observational and prospective cohort study. There are some limits, like selection bias & confounding issues. The sample size of the study being only 50 made the statistical analysis weaker, both for univariate & multivariate tests.

We tried using a multivariate logistic regression model. It looked at the variables that did better than the univariate analysis. But we didn’t find any significance there.

We studied only 50 patients over a short period of 1 year with 6 months follow up. This created selection bias and made, to some extent, an inappropriate analysis overall. It also created a type 2 statistical error. Also, many international studies looked at a larger number of patients over a long time period. If we had analysed a larger group (more than 500 patients), our study would have found a much stronger significance.

13. Conclusion

Our study might have a small sample size, but it still shows interesting trends similar to what we see in big international studies. The most common level of cervical spine injury (CSI) has been found to be at the C1/C2 and C5/C6 levels. Plus, we noticed more cervical cord injuries and disc problems happening at lower levels of the neck as we looked further down.
This information tells us that we need to take quick action when dealing with CSI, especially after road accidents or when there are injuries to the face that come with fractures. Fast referrals to neurosurgeons in the emergency ward can help a lot as both CSI and craniomaxillofacial injuries are managed side by side.
Interestingly, our findings highlight just how critical it is to do a thorough clinical and radiological examination when someone has concomitant facial and cervical spine injuries. We need to keep an eye out for neck injuries too as these are often missed if the pain from other body parts takes dominance. The age group is usually a man around 40 years old, often caught up in a traffic accident. It's crucial we stay alert for this kind of concomitant injuries at this age group.

In our study, concomitant craniomaxillofacial injuries in cervical spine injury patients had a incidence rate of 58% with highest incidence in young (21-30 years) at 36%, and male with incidence of 76%. The most common mode of injury is high velocity RTAs (66%), mostly due to hyperflexion neck injuries (56%), and most common cervical level of involvement at C5/C6 and mid facial involvement. The lower cervical injuries are more commonly associated with mid facial fractures and upper cervical injuries more common with mandible fractures.

66% patients presented with Quadriparesis, 48% of which had incomplete ASIA (ASIA B, C, D) on presentation. Upper cervical fractures were more commonly associated with ASIA-A (34.78%) and lower cervical with ASIA- B/C/D (69.23%).

Interestingly, we found that most of the facial injuries in association with cervical spine injuries were minor injuries, 38% of which had only facial abrasions. 47% of the patients with facial injuries were managed conservatively and only 3 patients (6%) underwent surgical procedures (ORIF) for facial fractures.

On the other hand, 56% cervical spine injury patients had to be managed surgically, of which38% required anterior Cervical fixation and 18% required posterior Cervical fixation procedures.

Most common postop ICU complication to deal with was Ventilator associated pneumonia (30%) followed by Hospital acquired pneumonia (22%) with mean ventilator days being 6.9±9.28 SD, and mean hospital days being 17.58±11.82 SD.

12.5% patients were discharged with ASIA A, 60% with incomplete ASIA (B, C, D), and 27.5% in NLI state, which changed at 6 months follow up to 7.5%, 37.5%, and 55% respectively which showed a good prognosis of cervical decompression in traumatic CSI patients in the long run. We also found a statistically significant association of better clinical outcome with lower cervical injuries than in upper cervical injuries.

We had a total mortality of 20% during hospital stay and no mortality during follow up period.

Figure 32: Facial fracture distribution

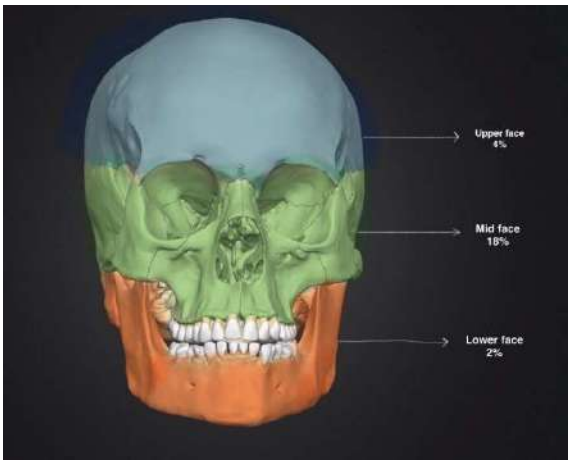
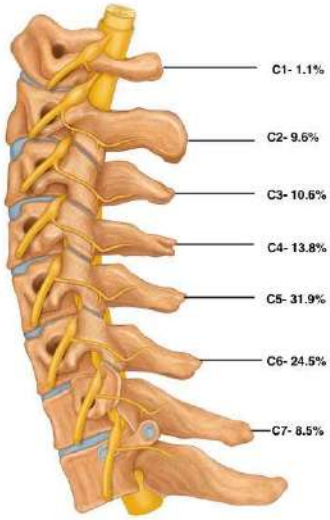


Figure 33: incidence of Cervical spine injury at each level



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15. Annexures

15.1 Participant Information Sheet

STUDY TITLE: An observational study to determine the association of Craniomaxillofacial injuries in patients with cervical spine injuries at Tertiary care Centre in India.

STUDY INVESTIGATORS:

Student: (Name, Department): Dr Kaustav Saha**,** Department of Neurosurgery

Guide (Name, Department): Dr. Pradeep Chouksey, Associate Professor, Neurosurgery

Co- Guide/s: Dr. Amit Agrawal, Professor and HOD, Neurosurgery

Dr Adesh Shrivastava, Additional Professor, Neurosurgery

Dr. Babulal, Assistant professor, Trauma and Emergency

Dr. Jitendra Sharma, Assistant Professor, Radiodiagnosis

Introduction:

We are conducting a research study to determine the association of Craniomaxillofacial injuries in patients with cervical spine injuries in AIIMS Bhopal. We would like to examine you both clinically and radiologically and treat your injuries, and later follow up for the next 6 months to assess your outcome. If you agree to take part voluntarily, we will ask you to sign a consent form.

Purpose of the study:

The aim of our study is to estimate the incidences of combined cervical spine with Craniomaxillofacial injuries coming to AIIMS Bhopal and to determine the anatomical level of cervical spine injuries and each of their association with types of Craniomaxillofacial injuries. This will help us assess the outcome in patients with combined injuries and to formulate the management protocol for combined injuries.

Taking part – what it involves:

Do I have to take part?

Participation in this research is entirely voluntary. A decision to not take part, or to withdraw at any time, will not affect your rights or medical care in any way.

What is expected of me if I take part?

If you participate, we will collect information about all details of your injury, undergo few blood tests and radiological investigations

How long will my part in the study last?

Your participation in the study would last for this hospital stay and follow up at 1 month, 3 month and 6 months.

Do I have to come for extra visits or undergo extra investigations for the study?

Yes, at 1st month, 3rd month and 6th month follow ups. We will get a CT/MRI spine for you to assess postop recovery.

What are the possible benefits in taking part?

Taking part will help gain knowledge about mechanism of trauma responsible for the severity of injury and how to prevent it, and management, which may result in improvement of management and outcomes for you / patients like yourself.

What are the possible disadvantages and risks of taking part?

There are no major foreseeable disadvantages or risks because of the study. There may be risk of loss of privacy and confidentiality of information collected even though all possible measures will be taken to ensure safe data storage and access.

What happens to the information collected from me?

All information collected will be kept strictly confidential and not shared with anyone. Results from the study will be reported as group data and will not identify you in any way.

What if I change my mind regarding participation in the study?

You are entitled to change your mind and withdraw at any time during the study without any disadvantage or penalty.

Whom do I contact for more information or if I have further questions or concerns?

If you want any information or have questions or concerns, you can contact:

Dr. Kaustav Saha
Senior Resident,
Neurosurgery, AIIMS Bhopal
9903012283
kaustav.neurosurgery@aiimsbhopal.edu.in

Dr. Shashank Purwar
Member Secretary,
Institute Ethics Committee – Student Research
7773010099
ihecpgr@aiimsbhopal.edu.in

15.2 प्रतिभागी सूचना पत्र

1. **अध्ययन का शीर्षक**: भारत में तृतीयक देखभाल केंद्र में ग्रीवा रीढ़ की चोटों वाले रोगियों में क्रानियोमैक्सिलोफेशियल चोटों के संबंध को निर्धारित करने के लिए एक अवलोकन अध्ययन
2. **अध्ययन जांचकर्ता**
3. **छात्र** (नाम, विभाग): डॉ कौस्ताव साहा, न्यूरोसर्जरी
4. **मार्गदर्शक (गाइड)** (नाम, विभाग): डॉ प्रदीप चौकसे, न्यूरोसर्जरी
5. **सह मार्गदर्शक/कों** (नाम, विभाग): डॉ. अमित अग्रवाल, प्रोफेसर और एचओडी, न्यूरोसर्जरी
   डॉ. आदेश श्रीवास्तव, एसोसिएट प्रोफेसर, न्यूरोसर्जरी
   डॉ. बी.एल. सोनी, सहायक प्रोफेसर, ट्रॉमा और आपातकालीन
   डॉ. जितेंद्र शर्मा, सहायक प्रोफेसर, रेडियोडायग्नोसिस
6. **परिचयः**

हम एम्स भोपाल में सर्वाइकल स्पाइन की चोटों वाले रोगियों में क्रानियोमैक्सिलोफेशियल चोटों के संबंध को निर्धारित करने के लिए एक शोध अध्ययन कर रहे हैं। हम आपको चिकित्सकीय और रेडियोलॉजिकल रूप से जांचना चाहते हैं और आपकी चोटों का इलाज करना चाहते हैं, और बाद में आपके परिणाम का आकलन करने के लिए अगले 6 महीनों तक पालन करना चाहते हैं। यदि आप स्वेच्छा से भाग लेने के लिए सहमत हैं, तो हम आपको एक सहमति फॉर्म पर हस्ताक्षर करने के लिए कहेंगे

7. **अध्ययन का उद्देश्यः**

हमारे अध्ययन का उद्देश्य एम्स भोपाल में आने वाली क्रानियोमैक्सिलोफेशियल चोटों के साथ संयुक्त ग्रीवा रीढ़ की घटनाओं का अनुमान लगाना है और गर्भाशय ग्रीवा रीढ़ की चोटों के शारीरिक स्तर और क्रानियोमैक्सिलोफेशियल चोटों के प्रकारों के साथ उनके प्रत्येक संबंध को निर्धारित करना है।

यह हमें संयुक्त चोटों वाले रोगियों में परिणाम का आकलन करने और संयुक्त चोटों के लिए प्रबंधन प्रोटोकॉल तैयार करने में मदद करेगा।

8. **भाग लेना – इसमें क्या शामिल है ?**

a. **क्या मुझे भाग लेना चाहिए ?**

इस शोध में भागीदारी पूरी तरह से स्वैच्छिक है। भाग नहीं लेने का निर्णय, या किसी भी समय वापस लेने का निर्णय, किसी भी तरह से आपके अधिकारों या चिकित्सा देखभाल को प्रभावित नहीं करेगा।

b. **यदि मैं इसमें शामिल होता हूं तो मुझसे क्या अपेक्षित हैं ?**

यदि आप भाग लेते हैं, तो हम आपकी चोट के सभी विवरणों के बारे में जानकारी एकत्र करेंगे, कुछ रक्त परीक्षण और रेडियोलॉजिकल जांच से गुजरेंगे।

c. **अध्ययन में मेरी भागीदारी कब तक चलेगी ?**

अध्ययन में आपकी भागीदारी इस अस्पताल में रहने और 1 महीने, 3 महीने और 6 महीने में फॉलोअप के लिए होगी।

d. **क्या मुझे इस अध्ययन के लिए अलग से आना पड़ेगा या अतिरिक्त जांच जरूरी होगी**

हां, पहले महीने, तीसरे महीने और छठे महीने के फॉलोअप में। पोस्टोप रिकवरी का आकलन करने के लिए हमें आपके लिए सीटी / एमआरआई रीढ़ मिलेगी।

e. इसमें शामिल होने से संभावित लाभ क्या है ?

भाग लेने से चोट की गंभीरता के लिए जिम्मेदार आघात के तंत्र के बारे में ज्ञान प्राप्त करने में मदद मिलेगी और इसे कैसे रोका जाए, और प्रबंधन, जिसके परिणामस्वरूप आपके / आपके जैसे रोगियों के लिए प्रबंधन और परिणामों में सुधार हो सकता है।

f. इसमें भाग लेने से संभावित हानि एवं जोखिम ।

अध्ययन के कारण कोई बड़ा निकट नुकसान या जोखिम नहीं है। गोपनीयता के नुकसान और एकत्र की गई जानकारी की गोपनीयता का खतरा हो सकता है, भले ही सुरक्षित डेटा भंडारण और पहुंच सुनिश्चित करने के लिए सभी संभव उपाय किए जाएंगे।

g. मेरे बारे में एकत्र की गई सूचना का क्या किया जाएगा ?

एकत्र की गई सभी जानकारी को सख्ती से गोपनीय रखा जाएगा और किसी के साथ साझा नहीं किया जाएगा। अध्ययन के परिणामों को समूह डेटा के रूप में रिपोर्ट किया जाएगा और किसी भी तरह से आपकी पहचान नहीं की जाएगी।

h. इस अध्ययन मे भाग लेने के लिए मेरे विचार बदलने पर क्या होगा ?

आप बिना किसी नुकसान या दंड के अध्ययन के दौरान किसी भी समय अपना मन बदलने और वापस लेने के हकदार हैं।

I. इस संबंध मे अधिक जानकारी के लिए या बाद मे मेरे मन मे कोई प्रश्न या शंका होने पर मुझ किनसे संपर्क करना होगा ?

यदि आप कोई सूचना चाहते हैं या आपका कोई प्रश्न है या शंका है तो आप इन नंबरों पर संपर्क कर सकते हैं:

डॉ. डॉ कौस्ताव साहा
वरिष्ठ निवासी
न्यूरोसर्जरी विभाग, एम्स, भोपाल
9903012283,
kaustav.neurosurgery@aiimsbhopal.edu.in

डॉ. शशांक पुरवार
सदस्य सचिव,
संस्थान आचार समिति – छात्र अनुसंधान
7773010099,
ihecpgr@aiimsbhopal.edu.in

15.3 PARTICIPANT INFORMED CONSENT FORM (PICF)

प्रतिभागी सूचना सहमति प्रपत्र

इस अध्ययन के लिए प्रतिभागी का पहचान नंबरः …….....
Participant Identification Number for this Study: ……...

अनुसंधान का शीर्षकः भारत में तृतीयक देखभाल केंद्र में ग्रीवा रीढ़ की चोटों वाले रोगियों में क्रानियोमैक्सिलोफेशियल चोटों के संबंध को निर्धारित करने के लिए एक अवलोकन अध्ययन

Title of Project : An observational study to determine the association of Craniomaxillofacial injuries in patients with cervical spine injuries at Tertiary care Centre in India

शोधकर्ता छात्र का नाम : डॉ कौस्ताव साहा फोन नं:.9903012283
Name of Student Investigator: Dr. Kaustav Saha **Tel No.(s)**: 9903012283

शोध मार्गदर्शक का नाम : डॉ प्रदीप चौकसे
Name of Thesis Guide : Dr. Pradeep Chouksey

मैंने दिनांक 20.08.2022 के सूचना पत्रक संस्करण II में दिए गए सभी तथ्यों को सावधानीपूर्वक पढ़ लिया है/ मुझे अपनी भाषा में स्पष्ट रूप से विस्तारपूर्वक समझा दिया गया है, और मैंने तथ्यों को पूर्णतः समझ लिया है। मैं पुष्टि करता/ करती हूँ, कि मुझे सवाल पूछने के अवसर प्रदान किए गए।
The contents of the information sheet version II dated 20 August 2022 that was provided have been read carefully by me / explained in detail to me, in a language that I comprehend, and I have fully understood the contents. I confirm that I have had the opportunity to ask questions.

मुझे इस अध्ययन की प्रकृति एवं उद्देश्य और इसके संभावित जोखिमों / लाभों तथा अध्ययन की अनुमानित अवधि एवं अन्य प्रासंगिक जानकारी के बारे में विस्तारपूर्वक समझा दिया गया है। मुझे पता है कि इस अध्ययन में मेरी भागीदारी स्वैच्छिक है तथा मैं इस अध्ययन से किसी भी समय बिना कोई कारण बताए, अपना नाम वापस लेने के लिए स्वतंत्र हूं और नाम वापस लेने पर मेरी चिकित्सा देखभाल या कानूनी अधिकारों पर कोई प्रभाव नहीं पड़ेगा।
The nature and purpose of the study and its potential risks/benefits and expected duration of the study, and other relevant details of the study have been explained to me in detail. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal right being affected.

मैं समझता/समझती हूं कि इस अनुसंधान में मेरी भागीदारी से मेरे बारे में एकत्र की गई जानकारी और मेरे चिकित्सीय दस्तावेजों के किसी भी भाग को एम्स के जिम्मेदार व्यक्तियों द्वारा ही देखा जाएगा। मैं इन व्यक्तियों को मेरे रिकॉर्ड प्राप्त करने की अनुमति प्रदान करता/ करती हूँ।
I understand that the information collected about me from my participation in this research and sections of any of my medical notes may be looked at by responsible individuals from AIIMS. I give permission for these individuals to have access to my records.

यदि प्रतिभागी बच्चा है तो उसकी मौखिक या लिखित सहमति प्राप्त की गई है।
If participants is child, his/her verbal of written assent has been obtained.

मैं उक्त अध्ययन में भाग लेने के लिए सहमत हूं
/I agree to take part in the above study.

_____

(प्रतिभागी के हस्ताक्षर / बांए अंगूठे का निशान) (Signature/Left Thumb Impression)
दिनांक/Date……स्थान/Place …….....

प्रतिभागी का नाम/Name of the participant…….....
पिता/पति/पत्नी का नाम /Son/Daughter/Spouse of…….
डाक का पूरा पता /Complete Postal Address ……....

अगर अशिक्षित हों / If illiterate.

सूचना पत्र को प्रतिभागी को पढ़ा और समझाया गया है और प्रश्न पूछने का अवसर दिया गया है। मैं पुष्टि करता हूं कि व्यक्ति ने स्वतंत्र रूप से अपनी सहमति दी है ।
The information sheet has been read and explained to the participant and given the opportunity to ask questions. I confirm that the individual has given consent freely.

कानूनी रूप से स्वीकार्य प्रतिनिधि या निष्पक्ष गवाह के हस्ताक्षर
Signature of Legally acceptable representative or impartial witness.
दिनांक/Date
एलएआर या निष्पक्ष गवाह का नाम / Name of LAR or impartial witness .
पता / Address :-

प्रमाणित किया जाता है कि उक्त सहमति मेरी उपस्थिति में प्राप्त की गई ।
This is to certify that the above consent has been obtained in my presence.

_____

छात्र शोधकर्ता के हस्ताक्षर दिनांक……. स्थान……
Signature of the student Investigator Date …… Place ……

कृपया ध्यान दें: सहमति प्रपत्र तीन प्रतियों में (1) रोगी के लिए, (2) शोधकर्ता, (3) संस्थान के लिए तैयार करें ।
(छात्रों से अनुरोध है कि आसानी से समझ आने योग्य हिंदी अनुवाद स्वयं तैयार करें)

NB: Three copies should be made for (1) Patient, (2) Researcher, (3) Institution

15.4 CASE RECORD FORM

PATIENT DETAILS

NAME

AGE/SEX

UHID

PLACE

CONTACT NO

DETAILS OF INJURY

DATE OF INJURY

MODE OF INJURY

(a) Linear Acceleration
(b) Linear Deceleration
(c) Angular rotation

MECHANISM OF INJURY

(a) Hyperflexion
(b) Hyperextension
(c) Axial loading

SITES OF INURIES

(a) Isolated cervical injuries
(b) Cervical with Craniomaxillofacial injuries
(c) Other associated injuries

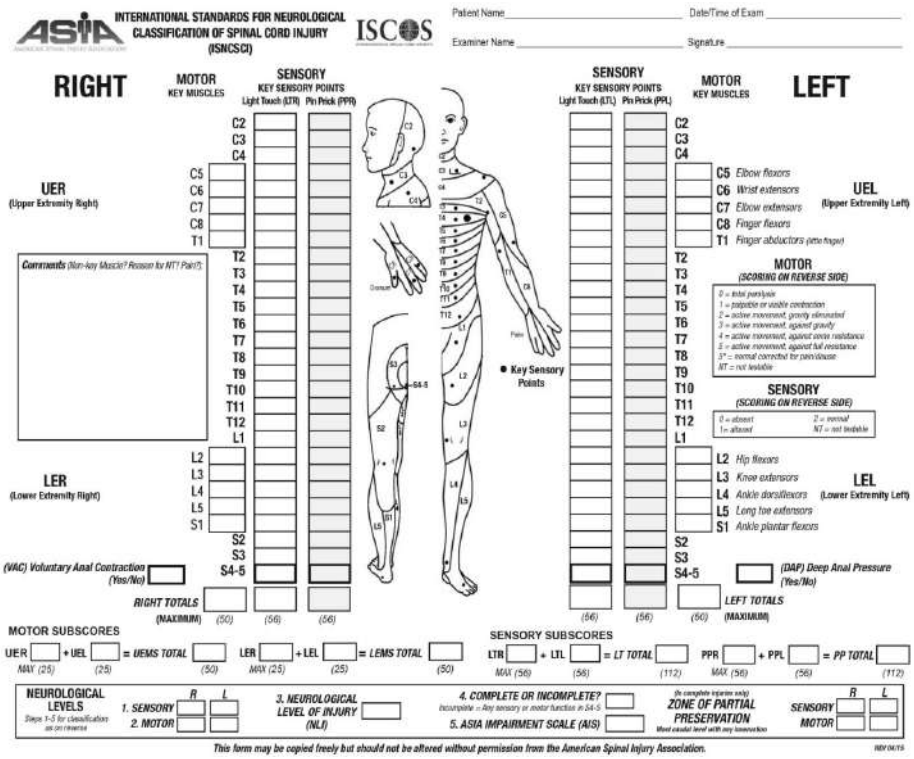
PRESENTING SYMPTOMS

(a) NEXUS Criteria
(b) Battle sign
(c) Racoon sign
(d) Rhinorrhea/Otorrhea

EXAMINATION FINDINGS

ASSESSMENT SCORES

(a) ASIA Impairment score



(b) SLIC score

Characteristics	Points
Injury morphology	
No abnormality	0
Compression	1
Burst	2
Distraction	3
Translation	4
Integrity of the disco-ligamentous complex	
Intact	0
Indeterminate	1
Disrupted	2
Neurological status	
Intact	0
Nerve root injury	1
Complete	2
Incomplete	3
Persistent cord compression	+1

SLIC: Subaxial Injury Classification

(c) Facial injury severity score

COMPREHENSIVE FACIAL INJURY(CFI) score

		c	d
Mandible			
	Dentoalveolar	1	2
	Body/Angle/Symphysis	1	3
	Ramus/Condyle	1*	5*
	Tot		
Mid-Face			
	Dentoalveolar	1	2
	LeFort I	1	4
	LeFort II	2	5
	LeFort III	4	6
	NOE	2	6
	Zygoma	2	4
	Nasal	1	3
	Orbital floor	2	5
	Medial wall	1	4
	Tot		
Upper face			
	Frontal sinus Anterior wall	2	4
	Posterior wall/Frontonasal duct	2	6
	Orbital roof/rim	2	4
	Tot		
Soft tissues		1**	5**
	Tot		

Unilateral Lefort fractures are assigned half the numeric value
Bone atrophy, extensive buttresses fragmentation or bone comminution add +3 points

"c" = Not displaced fractures, conservative management
"d" = Displaced fractures that needed O.R.I.F.

* Condyle "c" = intra-articular (displaced or not)
"d"= extra-articular displaced fractures

** Soft tissue "c" = Simple laceration, not complicated
"d" = Complicated (i.e. Facial or trigeminal nerve/salivary duct involvement, loss of tissues, human/animal bite, gunshot wound, lachrymal drainage system, retrobulbar hematoma)

RADIOLOGICAL FINDINGS

(a) CT Head with 3D Face

Pneumocephalus
Contusion/EDH/SDH/ICH
Frontal bone fracture
Mandibular coronoid/condylar/body/ramus fracture
LeFort fracture
Zygomatic arch fracture
Cribriform plate fracture
Orbital roof/walls/floor fracture
Walls of Frontal/Maxillary/Sphenoid Sinus fracture
Greater wing/Body/Lesser wing of Sphenoid fracture
Nasal bone/Septum/Root fracture
Pterygoid plate fracture
Temporal bone fracture
Occiput fracture

(b) CT Cervical Spine
Compression/ Burst/ Translation/ Distraction fracture

C1 – Jefferson(burst)/ Lateral mass/ Anterior arch/ Posterior arch fracture

C2 – Hangman fracture/ Odontoid fracture

C3-C7 – Lateral mass/ Posterior element fracture

MANAGEMENT DONE AT AIIMS

Closed reduction – Yes/No If Yes, for ____ days

DOSx from DOI – (a) Cervical –

(b) Maxillofacial –

Procedure – Decompression/ Anterior fixation/ Posterior fixation / 360 degrees fixation

Intraoperative duration –

Complications (if any) –

CLINICAL CONDITION AT DISCHARGE

GCS –

ASIA Score –

Maxillofacial trauma –

Wound status -

FOLLOWUP

(a) At 1 month Maxillofacial outcome -

(b) At 3 months Maxillofacial outcome –

(c) At 6 months Maxillofacial outcome -

Signature of Resident **Signature of Patient/Attendant**

16. Master Chart

16. MASTER CHART

NAME	AGE(Years)	GENDER	UHID	DOI	MODE OF INJURY	MECHANISM	SITES	C/F OF CERVICAL	C/F OF CMP INJURIES	UEMI SCORE	LEMI SCORE	TOTAL SENSORY	ASIA	SUC SCORE	CH SCORE	FACIAL DISTRIBUTION	CT HEAD FINDINGS	CT SPINE LEVEL	MANAGEMENT	PREOP VENTILATOR DAYS	DOS FROM DOI	SPINAL PROCEDURE	INTRA OP TRANSFUS	CMP PROCEDURE	INTRA OP TIME DATE	POST OP COMPLICATIONS	VENTILATOR DAYS	MORTALITY	HOSPITAL DAYS	ASIA AT DISCHARGE	RADIOLOGICAL OUTCOME NICTI	CMP OUTCOMES	WOUND STATUS	ASIA AT 1 MONTH	ASIA AT 6 MONTHS	ASIA AT 6 MONTHS
Sandeep Lodhi	22	M	23912210208690	20.10.22	Fall from height	Axial Loading	Isolated cervical	Quadriparesis	None	84	20	152	C	4	0	Nil	NAD Nasal bone # , left orbital	C5	Conservative	0	-	Conservative	-	Conservative	-	HAP	0	Alive	13	C	No abnormality	No deformity	Healthy	D	D	E
Abhishek	18	M	23912210199116	07.10.22	RTA	Hyperflexion	Cervical with CMP	Quadriparesis	Raccoon eye	8	0	26	B	8	5	Upper Face	Nil Lateral wall #	C5, C6	Conservative	0	-	Conservative	-	Conservative	-	HAP	0	Alive	19	B	No abnormality	No deformity	Healthy	B	C	D
Madan Basad	75	M	23912210238101	05.12.22	RTA	Hyperflexion	Cervical with CMP	Quadriparesis	Facial lacerations	66	10	66	C	8	1	Lower Face	NAD	C5, C6	Surgery	0	5	Anterior fixation	0	Conservative	-	HAP	0	Alive	16	C	Deconvenanced	No deformity	Healthy	D	D	E
Nalla Jan	27	F	23912210247040	16.12.22	Fall from height	Hyperflexion	Isolated cervical	Quadriparesis	None	22	0	26	B	7	0	Nil	NAD	C5, C6	Surgery	0	2	Anterior fixation	0	Conservative	-	VAP, Tracheostomy, Bronchoscopy	7	Alive	15	B	Deconvenanced	No deformity	Healthy	C	D	E
Nalla Jan	27	F	23912210238137	05.12.22	RTA	Hyperflexion	Cervical with CMP	Quadriparesis	None	22	0	26	B	7	0	Nil	NAD	C5, C6	Surgery	0	2	Anterior fixation	0	Conservative	-	VAP, Tracheostomy, Bronchoscopy	7	Alive	15	B	Deconvenanced	No deformity	Healthy	C	D	E
Vachana	22	M	23912210238317	27.11.22	RTA	Hyperflexion	Cervical with CMP	Quadriparesis	Facial lacerations	26	0	52	B	8	1	Mid face	NAD	C5-T1	Surgery	0	7	Anterior fixation	0	Conservative	-	HAP	3	Alive	22	B	Deconvenanced	No deformity	Healthy	B	C	C
Khushi	18	F	23912210212631	16.12.22	RTA	Hyperflexion	Cervical with CMP	Quadriparesis	Facial abrasions	56	0	152	B	6	1	Lower Face	NAD	C5, C6	Conservative	80	-	Conservative	-	Conservative	-	Nil	80	Alive	42	B	No abnormality	No deformity	Healthy	C	C	D
Shakthivelan	53	M	23912210253375	12.03.23	Fall from height	Hyperextension	Isolated cervical	Quadriparesis	None	94	20	180	C	0	0	Nil	NAD	C5, C6	Surgery	0	9	Anterior fixation	0	Conservative	-	Nil	0	Alive	12	C	Deconvenanced	No deformity	Healthy	D	D	E
Kanimoli Thakur	28	M	23912210262241	25.03.23	Fall of heavy object onto head	Axial Loading	Isolated cervical	Quadriparesis	None	6	0	26	A	7	0	Nil	NAD	C5	Surgery	0	6	Anterior fixation	0	Conservative	-	VAP, Tracheostomy	25	Alive	37	A	Deconvenanced	No deformity	Healthy	B	B	C
Bhanu Singh	50	M	23912210267087	30.03.23	RTA	Axial Loading	Cervical with CMP	Quadriparesis	Facial lacerations	32	0	26	A	6	1	Upper Face	NAD	C5,C6, C5, C6	Conservative	0	-	Conservative	-	Conservative	-	HAP	0	Alive	10	A	No abnormality	No deformity	Healthy	C	D	D
Nawneeta Singh Bashel	52	M	23912210276668	08.04.23	RTA	Hyperflexion	Cervical with CMP	Cervical tenderness	Facial lacerations	50	50	224	E	1	4	Lower Face	NAD	C5, C6	Conservative	0	0	Conservative	-	Conservative	-	Nil	0	Alive	5	E	No abnormality	No deformity	Healthy	E	E	E
Lalit Kumar	22	M	23912210116818	05.03.23	RTA	Hyperflexion	Isolated cervical	Quadriparesis	None	22	0	60	C	8	0	Nil	NAD	C5	Surgery	5	37	Anterior fixation	2	Conservative	-	Nil	0	Alive	20	C	Deconvenanced	No deformity	Healthy	D	D	D
Nandalal Uike	23	M	23912210099846	16.05.23	Fall from height	Hyperextension	Isolated cervical	Quadriparesis	None	88	84	224	D	8	0	Nil	NAD	C5	Surgery	7	33	Anterior fixation	2	Conservative	-	HAP	10	Alive	28	D	Deconvenanced	No deformity	Healthy	D	E	E
Bhuvi	19	M	23912210077731	06.05.23	RTA	Hyperflexion	Cervical with CMP	Cervical tenderness	Facial lacerations	50	50	224	E	0	1	Lower Face	NAD	C1	Conservative	0	-	Conservative	-	Conservative	-	Nil	0	Alive	4	E	No abnormality	No deformity	Healthy	E	E	E
Narayani Yadav	60	F	23912210116180	16.05.23	RTA	Hyperflexion	Cervical with CMP	Cervical tenderness	Raccoon eye	50	50	224	E	0	0	Upper Face	NAD	C2	Conservative	0	-	Conservative	-	Conservative	-	Nil	0	Alive	4	E	No abnormality	No deformity	Healthy	E	E	E
Ramchandra Kumawat	23	M	23912210116181	12.07.23	Fall from height	Axial Loading	Cervical with CMP	Quadriparesis	Facial lacerations	32	0	26	A	6	1	Upper Face	NAD	C5	Surgery	0	11	Anterior fixation	0	Conservative	-	Nil	0	Alive	8	B	No abnormality	No deformity	Healthy	B	C	D
Laxmi Ben Ramsukhsa	73	F	23912210240525	12.07.23	RTA	Hyperflexion	Cervical with CMP	Quadriparesis	Facial lacerations	0	0	26	A	5	1	Mid face	NAD	C2, C3, C5	Conservative	10	-	Conservative	-	Conservative	-	VAP, Tracheostomy	10	Dead	10	-	No abnormality	No deformity	Healthy	-	-	-
Dhan Singh	28	M	23912210158048	13.07.23	Fall from height	Hyperextension	Isolated cervical	Quadriparesis	None	84	0	56	B	6	0	Nil	NAD	C5,C6	Surgery	0	5	Anterior fixation	2	Conservative	-	VAP, Tracheostomy	8	Alive	15	B	Deconvenanced	No deformity	Healthy	B	C	C
Santosh Kumar Thakur	41	M	23912210191697	30.07.23	Fall from height	Hyperextension	Isolated cervical	Quadriparesis	None	96	20	168	C	8	0	Nil	NAD	C5	Surgery	0	31	Anterior fixation	4	Conservative	-	HAP	0	Alive	36	C	Deconvenanced	No deformity	Healthy	C	D	D
Bhuvitkar	60	F	23912210180570	16.08.23	Fall from height	Axial Loading	Isolated cervical	Quadriparesis	None	0	0	32	A	8	0	Nil	NAD	C5,C6	Surgery	20	27	Anterior fixation	3	Conservative	-	VAP, Tracheostomy	35	Alive	50	A	Deconvenanced	No deformity	Healthy	A	A	B
Lata Rakwar	28	F	23912210207296	12.10.23	RTA	Hyperflexion	Isolated cervical	Quadriparesis	None	0	0	8	A	1	0	Nil	NAD	C2	Conservative	4	-	Conservative	-	Conservative	-	VAP, Tracheostomy	4	Dead	5	-	No abnormality	No deformity	Healthy	-	-	-
Manoj Ahirwar	25	M	23912210268181	06.11.23	RTA	Hyperextension	Cervical with CMP	Quadriparesis	Raccoon eye	8	0	92	A	8	4	Mid face	ZMC #	C6, C7	Surgery	0	8	Anterior fixation	4	Conservative	-	VAP, Tracheostomy	7	Dead	10	-	Deconvenanced	No deformity	Healthy	-	-	-
Satish kumar Kalamder	31	M	23912210181683	05.11.23	Fall from height	Hyperextension	Isolated cervical	Left Ulnar Monoparesis	None	97	50	224	D	0	0	Nil	NAD	C2	Surgery	0	25	Anterior fixation	3	Conservative	-	Nil	0	Alive	30	D	Deconvenanced	No deformity	Healthy	E	E	E
Sanaeeta	26	F	23912210211729	05.12.23	RTA	Hyperflexion	Cervical with CMP	Quadriparesis	Facial deformity	88	80	160	C	0	8	Mid face, lower face	Le Fort II, III, Mandible #	C2	Surgery	0	15	Posterior fixation	4	ORIF	3	VAP, Tracheostomy	16	Alive	38	C	Deconvenanced	Mild deformity	Healthy	C	C	D
Ravishankar	84	M	23912210261214	12.12.23	RTA	Hyperflexion	Cervical with CMP	Quadriparesis	Raccoon eye	8	0	68	A	2	5	Mid face	ZMC #	C5,C6,C5,C6	Conservative	11	-	Conservative	-	Conservative	-	Nil	11	Dead	15	-	No abnormality	No deformity	Healthy	-	-	-
Anuj Thakur	19	M	23912210000619	22.12.23	RTA	Hyperextension	Isolated cervical	Cervical tenderness	None	50	50	224	E	0	0	Nil	NAD	C2	Surgery	0	25	Posterior fixation	3	Conservative	-	Nil	0	Alive	29	E	Deconvenanced	No deformity	Healthy	E	E	E
Sabbam	50	M	23912210000619	29.12.23	Fall from height	Hyperextension	Isolated cervical	Quadriparesis	None	6	0	26	A	7	0	Nil	NAD	C5, C6	Surgery	0	4	Anterior fixation	3	Conservative	-	VAP, Tracheostomy	11	Dead	15	-	Deconvenanced	No deformity	Healthy	-	-	-
Parvatam Vishakalanna	41	M	23912210002161	29.12.23	Fall of heavy object onto head	Axial Loading	Isolated cervical	Right Ulnar Monoparesis	None	65	50	176	D	9	0	Nil	NAD	C5, C6	Surgery	0	19	Anterior fixation	4	Conservative	-	Nil	0	Alive	20	D	Deconvenanced	No deformity	Healthy	E	E	E
Sunil Kumar Meena	32	M	23912210000634	05.01.24	RTA	Hyperflexion	Isolated cervical	Quadriparesis	None	6	0	26	A	6	0	Nil	NAD	C5,C6,C5,C6	Surgery	0	3	Anterior fixation	4	Conservative	-	VAP, Tracheostomy	4	Dead	5	-	Deconvenanced	No deformity	Healthy	-	-	-
Dhanraj	62	M	23912210002086	05.01.24	Fall from height	Hyperflexion	Isolated cervical	Quadriparesis	None	6	0	26	A	6	0	Nil	NAD	C5,C6,C6	Surgery	0	3	Anterior fixation	4	Conservative	-	VAP, Tracheostomy	4	Dead	5	-	Deconvenanced	No deformity	Healthy	-	-	-
Balkaran Kaur	65	M	23912210010271	10.01.24	RTA	Hyperextension	Cervical with CMP	Quadriparesis	Facial lacerations	80	0	180	C	6	1	Upper Face	NAD	C5,C6 C5,C6	Surgery	0	10	Posterior fixation	3	Conservative	-	HAP	0	Alive	16	D	Deconvenanced	No deformity	Healthy	E	E	E
Dinesh Chandra Chauany	63	M	23912210212581	12.01.24	Fall from height	Hyperextension	Cervical with CMP	Quadriparesis	Facial lacerations	20	80	128	C	5	1	Upper Face	NAD	C5 C6	Surgery	0	5	Posterior fixation	3	Conservative	-	HAP	0	Alive	13	C	Deconvenanced	No deformity	Healthy	D	D	E
Ragini Mavai	27	F	23912210036610	20.01.24	Fall from height	Axial Loading	Cervical with CMP	Left Ulnar Monoparesis	None	60	50	224	D	3	1	Mid face	Left temporal bone linear #	C6-C7	Conservative	0	-	Conservative	-	Conservative	-	Nil	0	Alive	10	D	No abnormality	No deformity	Healthy	E	E	E
Sachit Bai	65	F	23912210026979	01.02.24	RTA	Hyperextension	Cervical with CMP	Quadriparesis	Facial abrasions	0	0	26	A	7	1	Upper Face	NAD	C6 C5	Surgery	20	25	Posterior fixation	4	Conservative	-	VAP, Tracheostomy	25	Alive	31	A	Deconvenanced	No deformity	Healthy	A	A	A
Sushil Jain	25	M	23912210027670	03.02.24	RTA	Hyperflexion	Isolated cervical	Cervical tenderness	None	50	50	224	E	1	0	Nil	NAD	C7	Conservative	0	-	Conservative	-	Conservative	-	Nil	0	Alive	3	E	No abnormality	No deformity	Healthy	E	E	E
Ratu Soni	60	M	23912210014677	18.02.24	RTA	Hyperflexion	Cervical with CMP	Quadriparesis	Facial lacerations	10	0	116	B	5	1	Lower Face	NAD	C5 C6 C5 C6	Surgery	0	5	Posterior fixation	4	Conservative	-	VAP, Tracheostomy	8	Alive	18	B	Deconvenanced	No deformity	Healthy	C	D	D
Manavathi Yallawanthi	50	M	23912210016191	19.02.24	RTA	Hyperflexion	Cervical with CMP	Quadriparesis	Raccoon eye	6	0	52	B	2	0	Mid face	ZMC #	C5 C6 C5 C6 C7	Conservative	2	-	Conservative	-	Conservative	-	VAP, Tracheostomy	2	Dead	2	-	No abnormality	No deformity	Healthy	-	-	-
Anna Sahu	21	F	23912210114914	05.03.24	RTA	Hyperextension	Cervical with CMP	Cervical tenderness	Facial lacerations	50	50	224	E	0	1	Mid face	NAD ZMC #, temporal roof #,	C4	Conservative	0	-	Conservative	-	Conservative	-	Nil	0	Alive	5	E	No abnormality	No deformity	Healthy	E	E	E
Jitendra Kurmi	54	M	23912210075708	17.03.24	RTA	Hyperflexion	Cervical with CMP	Cervical tenderness	Raccoon eye	50	50	224	E	0	5	Mid face	foraminous and fabecloid part of temporal bone #	C3	Surgery	0	18	Posterior fixation	4	Conservative	-	Nil	0	Alive	23	E	Deconvenanced	No deformity	Healthy	E	E	E
Gomti Bai	68	F	23912210128501	18.03.24	RTA	Hyperflexion	Cervical with CMP	Left Ulnar Monoparesis	Facial lacerations	50	62	224	D	5	1	Upper Face	NAD	C6, C7	Surgery	0	6	Posterior fixation	3	Conservative	-	Nil	0	Alive	10	D	Deconvenanced	No deformity	Healthy	E	E	E
Sakun	38	M	23912210078703	20.03.24	RTA	Hyperflexion	Cervical with CMP	Cervical tenderness	Facial deformity	50	50	224	E	0	5	Lower face	Mandible #	C2, C6 C7	Conservative	0	5	Conservative	-	ORIF	3	Nil	0	Alive	12	E	Deconvenanced	No deformity	Healthy	E	E	E
Prem Sinah Sonwanshi	66	M	23912210109713	29.03.24	Fall from height	Axial Loading	Cervical with CMP	Cervical tenderness	None	50	50	224	E	0	0	Nil	NAD	C2	Conservative	0	-	Conservative	-	Conservative	-	Nil	0	Alive	4	E	No abnormality	No deformity	Healthy	E	E	E
Satendra Singh	25	M	23912210116378	05.04.24	Fall from height	Axial Loading	Isolated cervical	Quadriparesis	None	28	0	80	A	8	0	Nil	NAD	C6, C7	Surgery	8	12	Posterior fixation	4	Conservative	-	VAP, Tracheostomy	22	Alive	29	A	Deconvenanced	No deformity	Healthy	A	A	A
Vishal Vishwakarma	25	M	23912210085301	07.04.24	RTA	Hyperflexion	Cervical with CMP	Cervical tenderness	Raccoon eye	50	50	224	E	0	5	Mid face	ZMC #, Orbital floor #	C3	Conservative	0	-	Conservative	-	Conservative	-	Nil	0	Alive	5	A	No abnormality	No deformity	Healthy	E	E	E
Mahendra Singh Tomar	63	M	23912210111261	08.04.24	RTA	Hyperflexion	Cervical with CMP	Quadriparesis	Raccoon eye	0	0	26	A	9	3	Upper Face	Orbital roof #	C5, C6	Surgery	5	7	Anterior fixation	4	Conservative	-	VAP, Tracheostomy	17	Alive	22	A	Deconvenanced	No deformity	Healthy	A	A	A
Ramkishan	86	M	23912210125851	13.04.24	RTA	Hyperflexion	Cervical with CMP	Cervical tenderness	Facial lacerations	86	20	72	C	0	2	Upper Face	Frontal, Nasal	C7, D1	Conservative	0	-	Conservative	-	Conservative	-	HAP	0	Alive	33	C	No abnormality	No deformity	Healthy	C	C	D
Chain Singh	65	M	23912210129762	15.04.24	RTA	Hyperflexion	Cervical with CMP	Quadriparesis	Facial lacerations	18	0	66	A	9	1	Upper Face	NAD	C6, C7	Surgery	2	0	Anterior fixation	4	Conservative	-	VAP, Tracheostomy, Imobilisn displacement	13	Dead	13	-	Deconvenanced	No deformity	Healthy	-	-	-
Mustak Shah	61	M	23912210261725	19.04.24	RTA	Hyperflexion	Isolated cervical	Right Ulnar Monoparesis	None	86	50	224	D	6	0	Nil	NAD	C5,C6	Surgery	0	7	Anterior fixation	3	Conservative	-	Nil	0	Alive	15	D	Deconvenanced	No deformity	Healthy	E	E	E
Kaul	23	M	23912210059369	16.04.24	RTA	Hyperflexion	Cervical with CMP	Cervical tenderness	Facial abrasions	50	50	224	E	0	1	Upper Face	NAD	C1 C2	Conservative	0	-	Conservative	-	Conservative	-	Nil	0	Alive	5	E	No abnormality	No deformity	Healthy	E	E	E
Nawal Kishore Mahato	47	M	23912210096603	18.04.24	RTA	Hyperflexion	Cervical with CMP	Cervical tenderness	Raccoon eye	50	50	224	E	0	5	Upper Face	Frontal Parietal depressed #	C6, C5	Surgery	0	2	Anterior fixation	-	Debridement + elevation	0	Pulmonary embolism, ARF	5	Dead	21	-	No abnormality	No deformity	Infected	-	-	-